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AUTHOR Burgess, Tyrell; Pratt, John
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ABSTRACT

This case study is concerned with 3 major innovations in higher education in England and Wales: creation of the National Council for Technological Awards, designation of 10 colleges of advanced technology, and designation of 30 polytechnics formed from existing colleges or groups of colleges. Following a suggested outline, this book includes: an introduction explaining objectives, the scope of the study and methods used; a general description of the reforms and their relationship to the country's educational and social systems; an analysis of the innovations in relation to expanding enrollments, size and growth problems and their translation into building concepts; and the provision of equal educational opportunity. The reforms are also analyzed with regard to: curricular changes such as interdisciplinary studies, the creation of institutions specializing in particular fields, organizational structure including institutional autonomy, administration and management, recruitment and status of teachers, teaching and research, teacher-student relations, and the role of students in the academic community. Consideration is given to the changing role of higher education in society, the incorporation of evaluation and planning methods in the new institutions, and planning. A lengthy appendix contains tabular data. (JS)

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CASE STUDIES
ON
INNOVATION IN HIGHER EDUCATION

technical education in the UNITED KINGDOM

by
Tyrell BURGESS and John PRATT

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

The Organisation for Economic Co-operation and Development (OECD), was set up under a Convention signed in Paris on 14th December, 1960, which provides that the OECD shall promote policies designed :

- *to achieve the highest sustainable economic growth and employment and a rising standard of living in Member countries, while maintaining financial stability, and thus to contribute to the development of the world economy ;*
- *to contribute to sound economic expansion in Member as well as non-member countries in the process of economic development ;*
- *to contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.*

The Members of OECD are Austria, Belgium, Canada, Denmark, Finland, France, the Federal Republic of Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.

FOREWORD

Whereas in the nineteen-fifties and the early sixties, the notion of "educational investment" attracted the greatest attention, it is now increasingly recognized that educational systems in general, and higher education in particular, cannot adequately respond to the needs of the economy and society unless they are subjected to more or less profound adaptations implying equally important innovations. Thus, in many ways, "innovation" becomes the key concept in the development of education of the present and coming decades.

Innovation is not of course required or advocated for its own sake, but should be understood as a means for fulfilling functions or resolving problems of an urgent nature and which have so far been neglected. The term "innovation" as it is used here, and as distinct from "change", implies therefore purposeful orientation.

The subject covers a very wide range of topics. Innovations in practically all educational domains can be considered: curriculum, teaching methods, internal structures, administration, equipment, etc. Obviously, no single study can cover more than a fraction of this vast area and an appropriate delimitation of the field of inquiry is indispensable. It was therefore decided that a set of case-studies on innovations as introduced by a representative sample of major overall reforms of higher education and in some of the newly created universities represented the most suitable approach to a study of this problem.

It does not follow that a new university is necessarily an innovating university, or that an overall reform need be, in all circumstances, of a radically innovating nature. Furthermore, many important innovations — of curricula or of teaching methods for example — can be and are being introduced in existing universities and without calling for the promulgation of an overall reform. The fact remains, however, that in most cases these are the two basic tools used to implement innovation in the system as a whole or in some of its parts.

It is in this context that the OECD Committee for Scientific and Technical Personnel[1] decided to include in its current programme a number of case-studies concerning problems of innovation in higher education in Member countries.

The present volume on Technical Education in the United Kingdom is the fifth of this series of case-studies*. It expresses the views of the authors and not necessarily those of the Organisation or the British Government.

1. Replaced by the Education Committee as from July 1970.

* The other four are: *New Universities in the United Kingdom, Three German Universities, Reforms in Yugoslavia, French Experience before 1968.*

COMMON OUTLINE FOR THE PREPARATION OF CASE-STUDIES

The following general guidelines were given to the authors:

1. The case-studies should not be developed in terms of mere descriptions (of a particular reform or institution) or historical accounts; *they should be analytical and endeavour to present a critical examination,* the responsibility for which shall lie with the respective author(s).

2. The case-studies should represent a combination of an *institution- and problem-oriented approach* centred around the phenomenon of innovation. It is not the new institutions or reforms *per se* which should be reviewed and analysed and the case-studies should not engage in a theoretical discussion on problems of higher education, but emphasis should be put on the question of how the selected institutions or reforms innovate with regard to the particular problems of the common outline.

3. Each of the case-studies should deal with only a limited number of institutions or reforms, although in some cases a wider area may have to be covered, i.e. the inclusion of innovations taking place within other institutions, old or new. Such an extension would be justified in particular if the selected new institutions or reforms do not provide a sufficiently representative and significant picture of the innovating process as a whole.

4. Particular attention should be paid to innovations which have been in operation sufficiently long to provide the necessary elements for an adequate evaluation of their effectiveness. This evaluation should deal both with the intended and the unpredicted effects of the innovation. Where the time-factor does not allow for such evaluation, the analysis should concentrate on the declared or implicit intention of the innovators and also on any public discussions they may have generated.

5. An analysis should be made of the rationale behind all of the innovations and consideration given to such questions as to who were the initiators and what groups or factors provided support for or resistance to the innovations.

6. The common outline should be considered as a flexible framework; authors remain free to decide where, in view of the case considered and of its specific national or local context, the emphasis should lie, which points should be developed in depth and which should be discussed only briefly or omitted altogether. Many, if not all, of the points of the common outline are closely interconnected, possibly even overlapping. Given the

nature of the subject, these interconnections are inevitable and their analysis will throw light on the innovating process as a whole.

The following common outline was suggested to all authors of case-studies on innovation in higher education, as undertaken within the programme of OECD's Committee for Scientific and Technical Personnel (CSTP). This outline was drawn up at a meeting of the Secretariat of OECD and the authors of the first five case-studies in May 1967.

A. *INTRODUCTION*

Specific objectives, scope of study, methods and data used, limitations.

B. *GENERAL CONTEXT*

i) Short overall description of institutions or reforms selected for study;

ii) Their place in the global context of the society and of the education system of the country concerned (including considerations on the status of the new institutions in relation to older establishments, e.g. problems of "upward mobility" of institutions of higher education);

iii) Factors and circumstances which led to their creation or promulgation; initiators, protagonists and supporting groups; resistance and opposition.

C. *PROBLEM-ORIENTED ANALYSIS*

a. *Coping with Increased Numbers*

There can be no doubt that this is the most important problem in the development of almost all higher education systems. In the framework of the case-studies, questions of the following type should be examined:

- To what extent and in what sense was the promulgation of reform X — the creation of Institution(s) Y — directly motivated by the need to cope with the past or projected quantitative expansion of enrolments? (Was the pressure of numbers a primary or a secondary motive?) What statistical evidence can support the answer to this question and how has implementation of the reforms — or the building-up of the institution(s) — responded to original quantitative expectations?
- In case-studies on new institutions the problem of *size* should also be examined: what rationale, and other factors, determined the decision on the size of the new institution(s)? How is the problem of numbers being solved within the framework of the new institution(s) (e.g. subdivision of the institution in smaller more or less autonomous units as in the British collegiate or in the American cluster-college system)? What is the actual and projected rate of growth (slow or fast) of the new institution(s) and on what rationale is this growth rate based?
- In what way has the policy concerning the size of new institutions been translated into new architectural and building concepts?

b. *Equality of Opportunity*

The higher education systems of all OECD countries have to respond not only to the sheer pressure of numbers but also to the requirements of a more equal participation of the different social classes and population

groups, of a better geographic distribution (regional), and of a better participation according to sex.

— To what extent do the analysed institutions or reforms provide new answers to these preoccupations? More specifically, have the reforms or the institutions under review been innovative with regard to admission requirements (problem of access to higher education), with respect to scholarship and other student welfare policies? Have any new measures been introduced facilitating not only access of students from under-privileged classes or population groups to higher education but also strengthening the chances of success of these students? To what extent does the location of new institutions respond to requirements of a better geographic distribution of post-secondary establishments (problems of the "university map")?

c. *Content and Structure of Studies, Interdisciplinary Approach*

Problems falling under this heading are widely discussed, and new solutions are being introduced, in all OECD countries. In a certain sense it might even be said that the most striking features of new institutions of higher learning, i.e. the most apparent deviations from the traditional pattern, lie in this field: creation of interdisciplinary programmes, combined degrees; obligation or possibility for students to take courses belonging to different disciplines (major, minor or supporting subjects); obligation or possibility for teachers to belong to two or more constituent units of the University, etc.

— What is the rationale behind this type of innovation introduced by the new institution(s) or reform(s)? How were the programme, plan and length of studies changed (curriculum reform)? Has a new pattern of examinations (degrees) been developed? Does the available experience show that original expectations could be fulfilled? What difficulties arose and/or how was the arrangement transformed under the influence of unforeseen factors and circumstances?

— Did the new curricula and the new structures of studies bring about new architectural and building concepts? Did they have an influence on a better utilization of buildings?

d. *Specialization of Institutions of Higher Learning*

The question is more and more widely raised as to whether a single institution of higher learning can offer courses in more than a few subject areas. In particular, many of the new universities try to specialize in a limited number of areas. At the level of higher education systems as a whole, the issue is not only specialization by field of study but differentiation according to levels, geographic location and functions (e.g. creation of short cycle higher education).

— Has such a type of specialization taken place in the institutions under review and, if so, what were the criteria for the choices made? Is there any relation between a particular specialization and the geographic location of a given new institution?

— Do the analysed overall reforms contain any significant proposals such as the creation or strengthening of a new type of higher education

functionally differentiated from the traditional types, and what were the rationale and the factors which led to the solution adopted?

e. *Organisational Structures, Institutional Autonomy, Administration and Management*

In many countries the existing organisational structures (e.g. division of universities into faculties) are considered as totally inadequate and innovations in this field, together with those concerning the interdisciplinary approach, appear usually as the most revolutionary aspect of the new institutions. Related problems concern responsibilities of members of the academic staff, administration and management of institutions of higher learning as well as problems of institutional autonomy, of academic freedom and of State-University relations.

- What new organisational structures have been introduced (horizontal and vertical units and their interrelations)? What is the degree of organisational autonomy of the new units (on the one hand, internally, within the framework of the institution, and, on the other externally, in relation to the outside world)?
- What new approaches, if any, have the new institutions or the overall reforms developed towards the perennial question of university autonomy? Have the new institutions or reforms developed some new type of relationship between State and University, and if so, what were the consequences in the field of co-ordination of the new institutions with the rest of the higher education system? Have the new teaching methods or the new content of studies in some way modified the traditional concept of individual academic freedom ("Lerfreiheit")?
- How have the roles (authority, rights and responsibilities) of the various categories of the academic staff, (heads of department, chair holders, middle and junior staff level) been modified as compared with the traditional patterns? Can one speak of a new role of the faculty in the decision-making process in general and in the process of innovation in particular?
- What new administrative mechanisms have been set up? Are new scientific methods of administration (e.g. computer techniques) being extensively used?

f. *Recruitment and Status of Teachers*

For many countries the lack of qualified teachers represents the major bottleneck in the present and future development of higher education. A solution to this problem might depend, to a large extent, on better recruitment policies, improved salary conditions and career prospects. A related issue arises in connection with the instructional effectiveness of university teachers, and the criteria used for the appointment of such teachers.

- Have the institutions or reforms under review introduced new solutions in this field? Are candidates for teaching jobs sought outside the sectors which were traditionally supplying academic personnel (e.g. in industry)? Are conditions of employment of foreign teachers made easier? Have minimum academic requirements for employment (degrees, publications) changed and have criteria of teaching performance been adopted in the selection of staff?

g. *Teaching and Research*

One of the major criticisms made of higher education in most of the OECD Member countries refers to the balance between its teaching and research functions, to insufficient linkages between the two, to inappropriate conditions in which one or the other (if not both) have to be pursued and, implicitly or explicitly, to the connected problems of relations between undergraduate and graduate studies. Innovations in this area may pertain to numerous aspects and organisational components of the higher education system.

— How, in general, is the relationship between teaching and research and between undergraduate and graduate studies envisaged in the new institutions or reforms? What practical measures have been taken in the field of curriculum and degree requirements to implement these general principles? What arrangements have been made with a view to integrating (or differentiating) the teaching and research functions of the academic staff? If, in the older establishments major differences exist in prestige and working conditions between those occupied mainly in teaching (of undergraduates) and those in research (or work with graduates), have the new institution(s) or reform(s) changed this situation? How do enrolment growth rates (actual and projected) at the undergraduate level compare with those at the graduate level? Have any special arrangements been made to promote fundamental research as distinct from applied research? Is there any special effort being made with a view to training research workers ("teaching of research")? If the institutions and reforms under review are fostering research contracts with outside bodies (government, industry), what are the overall effects of this new relationship which is thus being built into higher education establishments?

h. *Organisation and Methods of Teaching; Teacher-Student Relations*

It is very often said that one of the major weaknesses in present higher education systems is the lack of contact between professor and student, in other words, the depersonalization of higher education. Many of the innovations introduced (both by the new institutions and by overall reforms) are intended to remedy this situation. The most obvious solution is to improve the teacher/student ratio, but this, for financial and other reasons, is also the most difficult solution and, in any case, only a partial one. Much will depend on the teaching methods: "cours magistraux", team teaching, tutorial system, seminar and small group work, utilization of new teaching media, the amount of time which the different categories of teachers actually devote to students both within and outside the class periods or formal "office hours", etc.

— To what extent does the teacher/student ratio (overall and by field of study) in the new institutions differ from the ratios in the older establishments? Can a more sophisticated indicator be established, comparing, for the traditional and new institutions, the size of classes, the length of time during which each student is in contact with his teachers, the number of courses (seminars, lectures), given by the various categories of teachers ("density of teaching")? What is the relative importance of formal and informal, organised and unorganised, contact between student and teacher?

- Which of the above-mentioned teaching methods (large-class lectures, seminars, tutorials, etc.) or what combination are given emphasis? Which method or combination is considered most and least effective according to fields and levels of study (optimum size of class)? What role has been assigned to new teaching media? What is the new or proposed structure of the teaching staff (number in senior, middle and junior level categories and their respective roles with regard to students)? What are the new arrangements with respect to student orientation and counselling?
- What physical facilities have been provided to facilitate closer contacts between teachers and students?

i. *Role and Status of Students in the Academic Community*

Two types of problems should be raised under this point: *a*) those concerning the participation of students in the decision-making process within their respective universities or other institutions of higher education, and *b*) those concerning their living conditions, residence, and material welfare in general.

- What innovations concerning these fields have been introduced in the institutions or reforms analysed? Are the new institutions deviating from the traditional pattern, for example in respect to the role of students in the determination of the structure and content of programmes or of admission requirement? What mechanisms are being used to ensure increased student participation in the decision-making process? Did these innovations have any important effect on the phenomenon of "students' unrest"?
- To what extent do students participate in the innovation process itself; by what means?
- What was the rationale for deciding that the institutions under review should be resident or non-resident establishments, with or without a campus? Why has a particular type of residence (e.g. collegiate versus simple hall of residence) been adopted. How has the relation between resident and non-resident students been solved? How have the connected architectural and building problems been solved? What other innovations have been introduced concerning the material conditions of students (part-time employment, loans)?

j. *Higher Education and the Outside World*

In many countries a major complaint about higher education is the latter's relative isolation from the outside economy and society in general, and from industry in particular. Modern higher education establishments should in this respect fulfil, it is said, several types of functions all of which, in a certain sense, may be grouped under the heading "Public Service Concept". This implies a more active role in such areas as adult and continuing education, extension services, research contracts with government and industry, etc. But successful innovations in these fields might often require a radical change in the prevailing idea of the university, i.e. in the concept of its place and role within society.

- Do the new institutions or reforms embody a new concept of the functions of higher education within society?

— What contacts have been established between the new institutions of higher learning and the surrounding community? Which groups and sectors of the economy and society appeared as most (least) willing to enter into co-operative arrangements with the new institutions? To what extent and in what way could the new institutions find support (e.g. research grants, scholarships, equipment) in industry and, *vice versa*, what new services are they providing for industrial firms (e.g. refresher courses)?

— Has a new approach to adult and continuing education been developed?

— Have extended linkages with the outside world led to any unforeseen problems and difficulties? Did the creation of the new institutions have a latent stimulating effect on the surrounding community (not directly related to the organised and institutional contacts, e.g. creation of various new services, shops, cultural activities, entertainment)?

k. *Evaluation and Planning*

Need for improvement in these areas is felt very widely. New techniques are being developed (e.g. systems analysis) and special mechanisms are being built into new institutions or reformed systems (planning and/or evaluation units) in order to fulfil this need.

— What are the respective solutions implemented in the institutions or reforms under review? Is self-evaluation and self-study considered as an integral part of the administration and planning of the new institutions? What difficulties had or have to be overcome in order to strengthen the planning process (at the level of the institutions or of the system)? What measures, if any, have been taken to ensure compatibility between institutional and national planning objectives?

l. *Cost and Financing*

Most if not all of the innovations analysed have cost and financial implications which should be examined. This can be done either in connection with almost all the eleven preceding problem areas or under a special separate heading. If the former solution is adopted, there should be a summing-up section on this point. The types of questions to be raised in both instances are as follows:

— Have the different innovations generated additional or increased expenditure or, on the contrary, have they produced savings or decreased unit costs? Have they made new financial resources available (e.g. innovations in the field of university-industry relations)? How do the overall costs and financing mechanisms of the new institutions compare with those of the older establishments?

D. *CONCLUSION*

Summary of main findings of the study with particular reference to the most important innovations encountered.

PREFACE

This case study is concerned with three major innovations in higher education in England and Wales: the creation of the National Council for Technological Awards (NCTA), the designation of ten colleges of advanced technology (CATs) and later of 30 polytechnics. Its object is to understand the fastest growing and most radically innovating sector of post-school education in this country.

Although the three parts of the study are intimately interconnected and cannot be fully understood apart from each other, they have developed over different periods of time. The NCTA pre-dated the CATs by a year, and it offered these colleges the academic basis for development. Later, transformed into the Council for National Academic Awards, it performed and is still performing the same service for polytechnics. Essentially both councils offer institutions other than universities the chance to create degree-level courses themselves, with the assurance and support of external moderation and assessment. This process is still developing and innovating.

The colleges of advanced technology are an example of a different method of innovation, in this case of creating institutions of higher education out of existing colleges whose functions have hitherto been different. The traditional way of founding universities in England has been to start from scratch – and there were many who believed that any attempt to do what the CATs eventually did was doomed to failure. Today the development is complete: The CATs are all universities or university colleges. Its consequences and implications both for the institutions themselves and for university education as a whole are clear, and we have described them in this study. With polytechnics, yet another method of innovation is being attempted: this time, to create a kind of institution of higher education, hitherto unknown in England, out of existing colleges or groups of colleges. The policy, recognizing and accepting a second "comprehensive" sector of higher education alongside the universities is only now being put into effect. We describe these early developments and examine their chances of success.

The methods used in the study have been twofold: first, to collect and analyse the available material (published and unpublished) on the institutions by a series of visits, interviews and discussions. The limitation of this is that we have not been able to undertake our own sociological surveys. We ought to say, however, that our own work and the work of others has not led us to suspect that such surveys would materially affect our conclusions.

There is one exception to this limitation. In the course of our work in the Unit, we have undertaken a complete study of the staffs of the colleges of advanced technology, and we have drawn on this where appropriate.

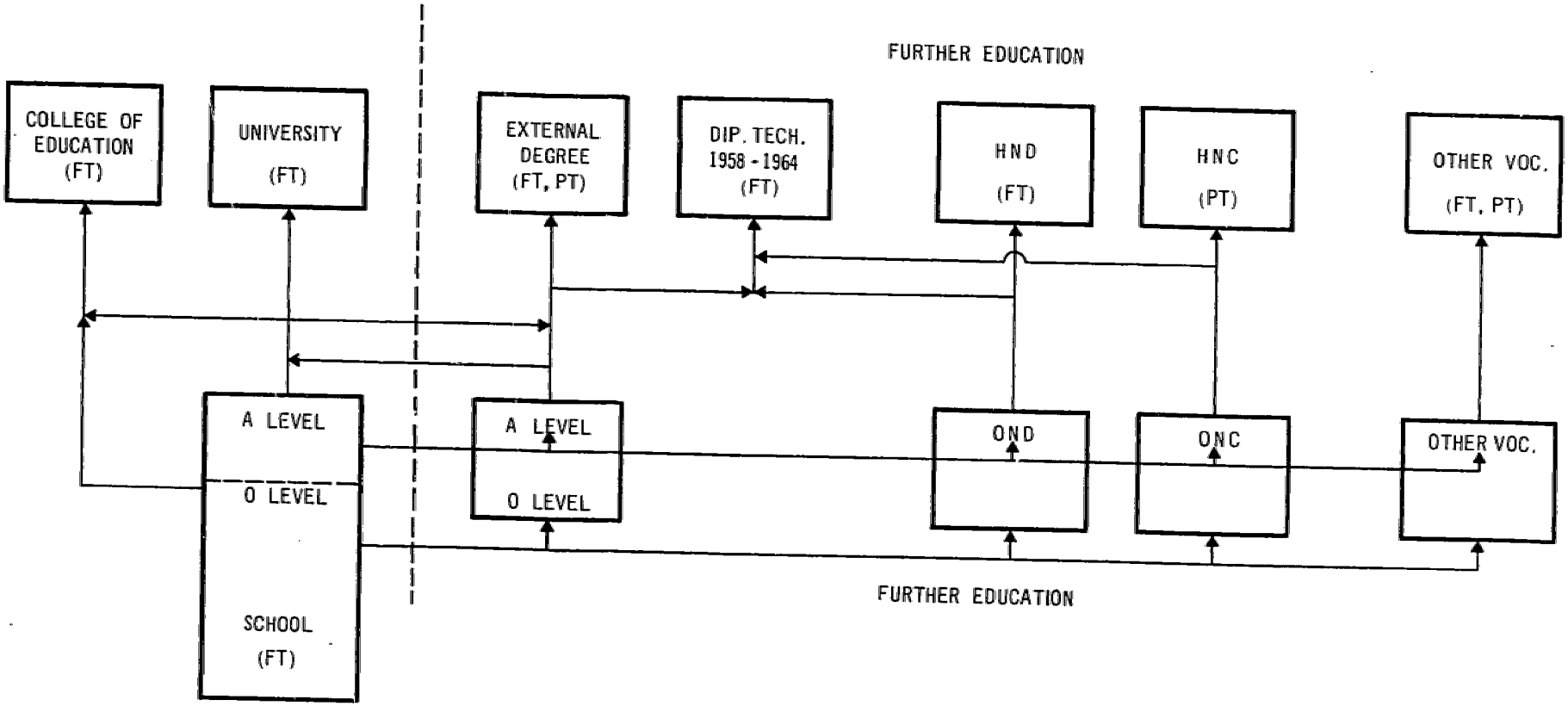
Like the others in the present series, this case study is based on the Common Outline drawn up by the Secretariat of OECD and confirmed by a meeting of the authors. The Outline proved to be particularly apt and helpful, and we wish to record our appreciation of the contribution of the Secretariat, particularly of Dr. L. Cerych and Miss D. Furth.

We should like to acknowledge the kindness we have received from the vice-chancellors and principals of the ten former colleges of advanced technology, their Registrars and administrative staffs, and particularly Sir Peter Venables, for his help and encouragement. We must thank, too, Mr. Hornby and the staff of the Council for National Academic Awards, and the principals of potential polytechnics who gave us data. Also Jennifer Pinney and the secretarial and administrative staff of the Unit, Bette Jory, Mary Shelley, Pam Mounsey and Cathy Peile have given us invaluable assistance. John King has made many constructive suggestions, Peter Harper's help was extremely useful. Finally, to our research assistants Roger Llewelyn, David Hollingsworth and particularly Peter Garner we are especially grateful.

Tyrell Burgess
John Pratt

Figure 1

ROUTES TO HIGHER AND FURTHER EDUCATION IN ENGLAND AND WALES



Note : Only the most common routes are shown.
Dip. Tech. became CNAA degree after 1964.

FT = Full-Time

PT = Part-Time

GLOSSARY OF ABBREVIATIONS

A level	Advance level (of General Certificate of Education)
CAT	College of Advanced Technology
CNAA	Council for National Academic Awards
DES	Department of Education and Science
Dip. Tech.	Diploma in Technology
FE	Further Education
GCE	General Certificate of Education
HNC	Higher National Certificate
HND	Higher National Diploma
LEA	Local Education Authority
MCT	Membership of the College of Technologists
M. Sc.	Master of Science
NACEIC	National Advisory Council on Education for Industry and Commerce
NCTA	National Council for Technological Awards
O level	Ordinary level (of General Certificate of Education)
ONC	Ordinary National Certificate
OND	Ordinary National Diploma
Ph.D.	Doctor of Philosophy
UGC	University Grants Committee
WEA	Workers' Educational Association

CONTENTS

INTRODUCTION: THE DEVELOPMENT OF TECHNICAL EDUCATION

Neither the National Council for Technological Awards and the Dip. Tech. nor the colleges of advanced technology and the polytechnics can be understood outside the context of the history of technical education in England. As with all English education the origin of technical education lay with private initiative, but the Government also took a sporadic interest from the beginning, and some of the most important developments were due to Government initiative.

Even in the eighteenth century mutual improvement societies of workmen had organised evening classes, but the establishment of mechanics' institutes in the early nineteenth century marks the effective beginning of technical education. Many of the colleges in this case study can be traced directly back to a mechanics institute. The institutes provided evening classes in the principles underlying various trades. Their failure to offer practical instruction and the workers' lack of elementary education gave them a pattern of initial enthusiasm, followed by decline (as they ceased to attract the workers for whom they were intended) into middle class philosophical and literary societies. Only in 1868 with the founding of the London Artisan's Club was instruction in trades and crafts offered and supported by the trades unions.

There were, at the same time, some outstanding individual initiatives, supported by the Queen's husband, Prince Albert. These had led to the founding of bodies like the Royal College of Chemistry and the Museum of Economic Geology in the early nineteenth century. In the latter part of the century, the philanthropist Quinton Hogg founded the Polytechnic[1] in London to attract those who would not normally have gone to evening classes with opportunities for recreation, social intercourse and education. The Polytechnic's trade classes were a great success, and there were 5,000 students within a year of its opening.

The first technical college in England was opened, with adequate laboratories and workshops, in 1881 by the City and Guilds of London Institute, which also established national examinations in technical craft and trade subjects and founded another college offering three-year courses in engineering. Nine other "polytechnics" were started in London before the

1. This name has now been given to new institutions in the White Paper of 1966.

end of the century, when an Act of Parliament enabled City charities to be used for this purpose.

Government initiative in technical education began after the Great Exhibition of 1851, at the instigation of those few individuals who saw that England's industrial supremacy was threatened by foreign competition. A Science and Art Department was set up which set examinations and supported science schools in which the teachers were paid on the basis of examination results. After a number of Royal Commissions had agreed that the state of science instruction was extremely unsatisfactory, the Government acted in the 1880s and 1890s. The Local Government Act created competent local authorities to whom powers and duties could be given, and the Technical Instruction Act said these local authorities could supply or aid technical instruction from the rates (local property taxes). In fact, the first educational activity in England supported by local authorities was technical instruction. Elementary education was the responsibility of separate school boards, and joined technical and secondary education under the local authorities only in 1902.

As the Local Taxation (Customs and Excise) Act was going through Parliament an enterprising MP slipped in a subsection empowering local authorities to spend their share of certain customs and excise duties on technical education. By the turn of the century the amount of this "whiskey money" spent on technical education was nearly £900,000 — or nearly 90% of all public expenditure for this purpose. In the last ten years of the century the whiskey money built 25 technical institutions and over 100 science schools.

But in some ways the most significant Government activity was in examinations. After the Science and Art Department was merged into the new Board of Education in 1899, its examinations were reorganised, and part-time technical education was based upon a group-course system: in place of single-subject examinations, a candidate had to offer a group of subjects. The most important innovation was that the Board endorsed certificates awarded by the colleges and schools.

In the 1920s there was a development of this system which profoundly influenced the later experience of the colleges in this case study. The Board of Education took the initiative in arranging with the Institution of Mechanical Engineers for national certificates and diplomas to be awarded jointly by the Board and the Institution on examinations in technical colleges. Under these arrangements a college prepared its own syllabuses and examined its own students. Nobody would claim that innovation or experiment was common; many colleges simply presented existing syllabuses, and uniformity was general. There were also some few cases of cheating. But on the whole the most obvious abuses were met by the fact that courses had to be approved by the joint committees and that examinations were externally assessed. An important principle of the national certificate scheme was that classwork, homework and laboratory work counted towards the final assessment. This made the final examinations less fearsome, but many students dropped out of the courses after relatively unimportant failure at earlier stages. The certificates were awarded after part-time study at two levels, ordinary and higher (the higher approaching the level of a university pass degree) and the diplomas were awarded at both levels after full-time

study. From the start the part-time certificate courses attracted the most students and, although the scheme covered science, chemistry and had been extended to include commerce, mechanical and electrical engineering still accounted for 80% of the passes, even in 1939.

For all its faults, the scheme enabled technical colleges to create their own syllabuses and run their own examinations for a nationally recognized qualification at a time when new university colleges were tied to the syllabuses and examinations of the University of London.

It may seem odd that little mention has been made so far either of the universities or of industry. Advocates of advances in technical education, from the eighteenth century onwards, complained of massive apathy from English industry. Warnings about the danger of competition from foreign industry with highly trained manpower with some notable exceptions have normally fallen on deaf ears.

On the other hand, the universities had not, on the whole, seen themselves as providers of technologists. Even in the mid-1950s pure science was having to establish itself in many universities. Technology was even more suspect. Even those who did graduate through the universities were commonly held to be too theoretical and little use in practical problems either in the laboratory or in industry.

We can in fact see growing up two traditions of education in the universities and the technical colleges — and the technical college tradition was reaching levels of education which had hitherto been confined to universities. The two traditions may be crudely summarized as follows: the universities were autonomous institutions concentrating on full-time students, concerned with knowledge for its own sake, having rigid entrance requirements whose influence stretched right down through secondary education; the technical colleges were public institutions run by local authorities, accommodating part-time as well as full-time students, concerned with professional and vocational education, and being open institutions with few formal entrance requirements. Of these, the university tradition was the one with a nationally accepted status.

But by the time of the Second World War the technical colleges were turning out more civil, electrical and mechanical engineers. The annual output of these in 1943 was:

Universities and university colleges (including the Royal Technical College, Glasgow, the London Polytechnics and the Manchester College of Technology)	1,250
Technical Colleges — Higher National Certificates and diplomas	1,300

These figures were given for the Percy Report[1] in 1945, which began the debate which produced the innovations we are studying and which is continuing to this day. The Percy Report assumed that 1,200 was the limit of desirable university expansion in these subjects and left it to the technical colleges to produce the rest. There were educational arguments advanced for both types of provisions. The universities insisted upon continuous academic study with at best vocational experience in industry. The technical

1. *Higher Technological Education*, Report of a Special Committee appointed in April 1944, HMSO, 1950.

colleges required part-time study from students whose major commitment was to a full-time job. (It ought to be said that the higher national certificates and diplomas were not designed as professional qualifications. When they came to be used for this purpose the professional institutions demanded additional qualifications for membership. Today one would not normally think of producing a table like that in the Percy Report because neither the DES nor the professional institutions regard HNC or HND alone as comparable with a degree).

The Percy Report worried that four-fifths of the HNC candidates were trained in evening classes alone, but thought that for two-thirds of them part-time study was right. For the remaining third it recommended substantial periods of continuous full-time study interspersed with work experience — the "sandwich" principle as it became known.

The Report also suggested the selection of a limited number of technical colleges in which new degree-level technological courses could be developed. A new National Council of Technology would be set up to award a national qualification of degree standard through an academic board of college representatives and independent members. Like the joint committees for national certificates, this council would not prescribe syllabuses or set and mark examinations, but would prescribe staffing and accommodation standards and approve external assessors for the final examination. A sense of tension between the technical colleges and the universities was shown by the committee's failure to agree on whether the new award should be called a degree or a diploma.

The Barlow Report[1] repeated these recommendations for the technical colleges and took further a suggestion of Lord Eustace Percy in an appended note to his own report that the proposed colleges of technology should be treated as a group from which some major university institutions should be developed.

The Percy Report's numerical suggestions were overtaken by events. The flood of ex-servicemen taking degrees and other courses after the war meant that the numbers of full-time students reading science and technology at universities more than doubled between 1939 and 1951 (as the Barlow Committee had recommended), and even after the ex-service surge had passed the numbers increased slightly to 29,000 in 1956. These students represented 34.5% of all university students as against 26% in 1930.

At the same time the numbers of degree-level students in technical colleges had also grown rapidly in the face of the ex-service demand. The colleges took 10,882 students in 1950, their highest year, of whom 5,756 took applied science, 4,755 pure science; 5,436 were full-time and 5,446 part-time. In 1949, 8,772 students in technical colleges were doing full-time university degree work (mostly external degrees of London University) and 11,295 part-time, and to this must be added a large, but unknown, number working in the evenings only.

The Percy Report's educational thinking was, however, neglected. After three years, and a working party recommendation, a National Advisory Council on Education for Industry and Commerce was set up. In 1950 this council recommended (again) that there should be a new

1. *Scientific Manpower*, Report of a Committee appointed by the Lord President of the Council, HMSO, 1946.

award for advanced work in technical colleges, to be given by a Royal College of Technologists. The courses and examinations were to be created by the colleges, approved and assessed by the Royal College. The Council also recommended that advanced work in technical colleges should attract a 75% grant from the Government.

At the same time, the Government was getting the opposite advice from the Advisory Council on Scientific Policy which was arguing[1] that the foundations of an education in higher technology could be laid only in the universities and that its development should be entrusted to them, not to the Ministry of Education and the local authorities.

By the White Paper of 1950[2] the Government had accepted the technical college argument. But it then went out of office, and its successor had to be convinced all over again. It agreed with the 75% grant, but the College of Technologists went into abeyance. The Government concentrated on the universities. On top of the £16 million building programme for teaching and research since 1945 (over 80% of which was for science, including technology and medicine) the Government started another programme including a £15 million expansion of the Imperial College of Science and Technology (University of London), a £1.5 million expansion of the Manchester College of Technology and a £6.5 million development programme for the civil universities.

But the Government began to be disenchanted with the universities. With all the money being spent on them, they still on the whole seemed to be reluctant to embrace technology as a university discipline. There was also an argument about the quality of university-trained technologists. The criticism of the university product was that he was too academic, too remote from industrial reality, barely interested in production and seeing his future in a university or research establishment rather than industry. Little of all this was said in public. In the House of Commons, the Minister simply said, "Whether the universities will wish or will be able to cope with their share of the increasing number of 18-year olds, I cannot say".[3] So again the Government came round to the view that the technical colleges should be expanded. The question was how.

There were two main arguments. The first derived from the whole history of technical education, and it is fair to say that the Ministry of Education were biased in favour of the historical process. The colleges themselves, as we have seen, had been given a taste for a substantial volume of advanced work after the war, and it would have required an untypical degree of dictation from the Ministry to stop this. The development of sandwich courses had given the colleges a distinctive academic ethos, which would enable them to be more than a second best to the universities, provided they could attract good staff and students.

At the same time, it was in the technical college tradition to offer whatever courses were demanded, either by students or by local industry. The spectrum of work in the colleges was therefore very wide. A single college might have work at both school and university level. To the Ministry it seemed right that advanced work should develop where it could,

1. *Second Annual Report of the Advisory Council in Scientific Policy.*
2. *The Future Development of Higher Technological Education*, HMSO, 1950.
3. *Hansard*, June 21, 1956, HMSO.

encouraged by the 75% grants. If one stopped an advanced course in one college in the interests of economy the students it was said, seldom went elsewhere; they just stopped going. If the colleges were to respond to local industrial demand, they had to meet those demands locally.

Outside the Ministry, however, pressure was growing for concentrating on advanced work in a few places. The professional institutions were anxious to find a more appropriate route to their professional members than that offered by HNC and were certain this should be offered in a limited number of places. Their arguments were both educational and economic: to spread advanced work all over the country would lead to the proliferation of expensive and academically weak departments. The Institutions demanded that the proposed advanced qualification should be available in, at most, half a dozen colleges: the Ministry could not see how it could be confined to fewer than 15.

In the end, both, or neither, won. First, in 1955, the Government set up the National Council for Technological Awards to administer a new degree award, the Diploma in Technology. (Notice that university jealousies triumphed again – the new award was not a degree — but it was for the last time). The Diploma in Technology was to be awarded for any course which had the Ministry and the NCTA's approval. A college like Woverhampton could get approval for one course alone. Proliferation had triumphed.

On the other hand, the year 1956 saw a reversal of the attitude of the Ministry of Education. In the White Paper [1] published in February, it listed the 24 colleges then receiving the 75% grant for advanced work, with the comment that "the Government now wish to see the proportion of advanced work at these colleges vigorously increased so that as many of them as possible may develop speedily into colleges of advanced technology". By the Parliamentary debate in the summer and the Ministry's Circular 305 a quite different pattern had emerged: there was to be a hierarchy of local, area and regional colleges, topped by eight (later 10) colleges of advanced technology. Concentration had also won.

But again, events were moving faster than policy. The demand from students which seemed to have slacked off in the early 1950s was now renewed. Nobody could hold advanced work to one group of institutions alone. Indeed the numbers of students doing advanced work grew three times faster in other colleges than in colleges of advanced technology. This growth in the technical colleges was due largely to the restrictionist policies of the universities which were not prepared to expand fast enough to take the growing numbers of those who would previously have been considered qualified.

In colleges of advanced technology themselves aspirations were growing. As the colleges shed their lower-level work and concentrated on work of university level it became hard to see why they should not be universities.

A step in this direction was taken in 1962 when the local authorities gave up their control of the colleges of advanced technology. The colleges became "direct-grant" institutions, getting their capital and current grants directly from the Ministry of Education. This short period (for most of

1. *Technical Education*, HMSO, 1956.

them it was only four years) is now regarded with some nostalgia in the colleges. They were all but autonomous institutions, and yet they were still, in a sense, the favoured colleges of the Ministry. Few would claim that they were short of money at that stage.

But it was the Robbins Report[1] in 1963 which made university status for the CATs almost inevitable. The Report said that it was anomalous that the colleges could not award their own degrees and recommended that they should in general become technological universities. What was more surprising was that the Robbins Committee reported that "this conclusion has commended itself to the Committee of Vice-Chancellors and Principals (of universities) and we have found no objection to the general principle in any quarter". The universities had come a long way since 1956, and they did so simply because the colleges of advanced technology had convinced them that they were of university status.

From 1964 onwards, then, the CATs were preparing to be universities. But what of the rest of the system of further education? The Government found itself facing similar problems as it had in 1956. At that time, there was no great unfilled demand for university-level places in science and technology. There were, as before, the same demands to rationalize the provision of advanced-level work. But a new note was heard in the discussions after 1964. The technical colleges were becoming more self-confident. The work of the NCTA and its successor the Council for National Academic Awards had shown not only that many of them were capable of university-level work but that some of them had as many students working at this level as some universities. The NCTA and CNAA degrees had also made it possible to do advanced-level work within the technical college tradition. A growing number of voices were heard to say that this tradition was as viable and as important as the university tradition.

When the Government brought out its White Paper in 1966,[2] it was seen to have been based upon this growing technical college self-confidence. It accepted the "binary" system of higher education in the jargon that grew up, with the universities forming one side and the technical colleges the other. It described the technical college side as a publicly administered one, responsive to social and industrial needs, containing "open" institutions offering a wide range of courses to full-time and part-time students. At the head of this sector there were to be 30 polytechnics — "comprehensive academic communities" offering courses at all levels of higher education, which was meant to include courses which finished above university entrance but below degree level. This development has only just begun. The local education authorities have submitted schemes of government for the colleges along the lines suggested by a Government committee. Twenty polytechnics will have been designated by the end of 1969.

This study will thus deal with three innovations. There is the development of the colleges of advanced technology. Here, new universities were created out of existing institutions of originally a quite different kind. In the policy for polytechnics, a new kind of institution of higher education

1. *Higher Education*, Report of the Committee appointed by the Prime Minister under the chairmanship of Lord Robbins, HMSO, 1963.

2. *A Plan for Polytechnics and Other Colleges*, HMSO, 1966.

is being created, again out of existing institutions. The innovation which helped to make the other two possible was the creation of a new kind of awarding body, the NCTA, for new kinds of courses in institutions which could not previously have awarded them. We have found it best to take these three in turn, though they are obviously interconnected, beginning with the NCTA.

I

THE NATIONAL COUNCIL FOR TECHNOLOGICAL AWARDS (NCTA)

In July 1955, the Minister of Education announced in Parliament that he had decided to accept the recommendation of the National Advisory Council on Education for Industry and Commerce (NACEIC)[1] for a national body to administer a new award for advanced work in technical colleges. The National Council for Technological Awards was set up under Trust Deed later that year. Its function was defined in the deed[2] "as an independent and self-governing body to create and administer technological awards of high standing having a national currency and available to students in technical colleges who successfully complete courses approved by the Council". In its recommendations the NACEIC had been at pains to retain a number of technical college traditions it considered valuable, whilst providing an award of equivalent standard to the external degree of the University of London. For most colleges the latter was the only award for which they could offer courses at first-degree level, but they were severely restricted by the subjects and syllabuses of the university. The NACEIC's proposal was an attempt to match the standard and status of the external degree whilst maintaining the responsiveness to local social and industrial demands that colleges were able to offer at other levels. We shall see that the NCTA drew heavily on the experience of the national certificate scheme courses which were created and examined by the colleges themselves and subject only to external assessment and approval by the Council.

In their first memorandum[3] the NCTA defined the principal features of the new award, which was to be called the Diploma in Technology (Dip. Tech.). The award was to be comparable with an honours degree at British universities, with two honours classes. A student who successfully completed the course would normally reach second-class-honours standard. Those who did not reach this standard would be considered for a pass-level

1. Ministry of Education. National Advisory Council on Education for Industry and Commerce. *The Future Development of Higher Education*. London, HMSO, 1950.

2. National Council for Technological Awards, *Declaration of Trust*, 22nd November 1956.

3. National Council for Technological Awards, *Memorandum on the Recognition of Courses in Technical Colleges leading to the Diploma in Technology*, London, 1955.

award. Courses were to be at least four years in length, and were to include an aggregate of not less than one year's integrated industrial training. Entrance to the courses was by GCE A level, a good Ordinary National Certificate (ONC), or equivalent qualification, though again flexibility was the keynote.

Courses generally took one of two forms, depending on the arrangements for industrial training. In what the NCTA called "sandwich" courses, the industrial and college periods were taken on alternate six months. On "full-time" courses, the industrial training was taken for a full year, and later regulations ensured that this was during rather than before the course. When in 1961 the Ministry of Education introduced a classification of courses, both types of course were in the sandwich group, and became known as "thin" and "thick" sandwiches respectively.[1]

The first courses for the Dip. Tech. were submitted by the colleges for approval during 1956, and suffered a pretty high rejection rate. Nevertheless, the first diplomas were awarded at the College of Advanced Technology, Birmingham in 1958. After that the number of courses approved by the Council increased steadily from 49 to over 100 in 1964, and the total number of diplomas awarded by 1965 was over 4,000.[2] In 1965, the number of Diplomas in Technology awarded was over 1,200.[3] This is equal to nearly a third of the 4,000 degrees in applied science awarded by universities that year.[4]

a) *Numbers and Opportunity*

The institution of the NCTA and the Dip. Tech. was never intended as a device to meet a specific target in the production of technologists. Much of the debate that preceded the creation of the Council (like the debates on technical education throughout the previous hundred years) was concerned with the supposed shortage of engineers and scientists in this country compared with other advanced countries. But the NCTA's main purpose in this context was rather to provide the means to produce graduate engineers from sources which had hitherto produced few. The actual numbers produced would always have depended upon a complex of pressures including industrial demand, Government policy, and a supply of candidates. The NCTA, then, simply encouraged growth in the colleges, provided that the courses came up to its rather exacting standards. This growth took place almost entirely in existing institutions so the problem of size was largely settled outside the Council's scope, as were the questions of subdivisions of institutions and architectural concepts. Its contribution to equality of opportunity was more significant.

The standard of entrance for Dip. Tech. courses was five passes in the General Certificate of Education examination (the normal university entrance requirement) with two appropriate subjects at advanced level, or a good Ordinary National Certificate or Diploma. The definition of "good"

1. *Statistics of Education*, 1961, Part II, p. 20, London, HMSO.

2. NCTA *Reports*, 1955–57 to 1963–64 and Council for National Academic Awards records, (Table 11). All figures quoted from NCTA reports are at 31st March each year.

3. CNAA records, (Table 12).

4. University Grants Committee, *Returns from Universities and University Colleges in Receipt of Treasury Grant*, 1964–65, London, HMSO.

in this context was left to the colleges, but normally meant an average of 60%. The Council recognized that candidates would have varied educational backgrounds, and that this would call for flexibility in the planning of the first year of courses. It was anxious that the entrance qualifications should not be rigid, and declared that "the prime consideration of recruitment is whether the student is likely to pursue the course successfully".[1]

Thus the Diploma in Technology can be seen as a specific measure to provide opportunity in higher education for people who had previously been excluded. Technical colleges had offered a number of courses to around degree level in the past. They included those for Higher National Certificates and Diplomas, external degrees of London University and professional qualifications. HNC and HND were regarded as approaching pass degrees only, but they did enable people without GCE qualifications to get to this level: The part-time certificate courses which were much more popular than the full-time diploma courses had the advantages of the "learning while earning" tradition of technical education but the path was a hard one. HNC courses at that time lasted for at least two years, and generally longer, involved sacrificing several evenings a week to study, and the drop-out rates were very high (43%).[2] The external degrees of London University, though of undisputed status, restricted the colleges and students to the courses and syllabuses of London University, and in addition were available only to students with the appropriate GCE qualifications. They had phenomenal wastage rates (63%).[3] Entrance to most of the examinations of the professional institutions was generally by means of the national certificates, so offered only the chance of improvement on this qualification for those that had already achieved it.

What the Dip. Tech. did was to extend the opportunities of further education to degree level. People who had left school with few or no GCE qualifications, perhaps because of financial or social pressures, were able through the further education system and generally by part-time study to obtain qualifications to these courses. They could then go on to a full-time course for an award recognized not only by the Government and industry but also by the Committee of Vice-Chancellors and Principals (of universities) as comparable to a university first degree.[4] About 25% of Dip. Tech. students had ONC or OND qualifications.[5]

The flexibility in the entrance requirements which the NCTA encouraged enabled colleges in many cases to accept students in courses leading to the Dip. Tech. even without the normal qualifications, and to provide preliminary training for them.

There is some evidence that the Dip. Tech. courses helped redress the imbalance in social class participation that is a feature of English higher education. The Robbins Report[6] found that the percentage of

1. NCTA, *Memorandum, op. cit.*
2. *Higher Education*, Report of the Committee appointed by the Prime Minister under the Chairmanship of Lord Robbins, 1961–63, HMSO, Appendix Two (A), Part IV, Table 44.
3. *Ibid.*, Table 38.
4. NCTA *Report*, 1951–59, Foreword.
5. See Table 1.
6. *Op. cit.*, Appendix Two (B), Part I, pp. 3-5.

students at university coming from working-class backgrounds (i.e. fathers in manual occupations) was the same (20%) in 1961 as in 1928, despite a doubling of the numbers of students. It found also that in further education, in full-time courses (mostly external London degree courses) there were 34% of students with working class parents.[1] But in sandwich courses, most of which led to the Dip. Tech. 44% of students were from working class homes.[2] In the population probably over 60% of people about student age have fathers in manual occupations. We have been able to obtain figures from Bradford University (formerly Bradford CAT) for 1964–65 and 1965–66 which show a similar picture. Of students in Dip. Tech. courses, 44% (exactly the same figure as Robbins for all sandwich courses) had parents in manual occupations, compared with 37% (Robbins 34%) on full-time courses.

There is very convincing evidence that the ONC and OND entrants to the Dip. Tech. courses performed just as well as the GCE entrants; most of the evidence in fact suggests that they did rather better. The NCTA itself conducted an analysis of the performance of the two types of entrants in 1962.[3] It is based on all the awards of the Dip. Tech. until the 31st March that year, and involves 16 colleges. ONC entrants performed better than GCE entrants in two ways. First, of the GCE entrants who earned the Dip. Tech., 12% got firsts whilst 17% of ONC entrants did. But, second, the ONC entrants did not get these awards at the expense of second-class diplomas; both types of entrants got about 65% seconds. Instead ONC entrants had a lower percentage of pass-level awards (19 compared with 25% GCE entrants). We have obtained figures from several of the CATs which confirm this pattern and also show that it remained much the same over a period of eight years from 1960 to 1967. Throughout the period there is little to suggest that, even with increased standards of GCE entrants, ONC entrants fared any worse or, conversely, that GCE entrants performed any better.

One of the CATs (Northampton) has been closely connected with London University for many years. Here also there is no significant change in the relative performance of the two types of entrants throughout the period, and ONC entrants, though getting about the same percentage of firsts as GCE entrants, have lower percentages for pass-level awards.[4] It is reasonable to expect that Northampton would attract GCE candidates of "normal" university standard, and this is to some extent confirmed by the constancy of the award figures now that the college has become an autonomous university. The performance of the ONC entrants in this case is therefore very encouraging.

It is also important to note that the ONC entrants' success was not restricted, as may have been expected, to engineering subjects. They also did better than GCE entrants in the NCTA's group of "other technologies". As this group includes subjects like mathematics, physics and applied biology, it confirms the general conclusion that the Dip. Tech. was

1. *Ibid.*, Table 102.
2. *Ibid.*
3. See Table 2.
4. See Table 3.

offering opportunities to people who could have gone to university given better fortune. There is one more important point to note in our analysis. ONC entrants had considerably lower wastage rates than GCE entrants on Dip. Tech. courses. This is particularly interesting in view of the high failure rate in general in the courses, which was a constant source of concern to the Council and the colleges. Evidence for this conclusion was available from two colleges only, but it is quite clear. At Brunel over a period of four years, 42% of GCE entrants failed to get a diploma,[1] compared with only 26% of ONC entrants. At Bradford the corresponding figures (based here on two years' entrance) are 35 and 29%.[2] The details from the NCTA and the other CATs do not take any account of wastage; they are in the form of method of entrance of students gaining awards. If, and there is no evidence to the contrary, similar wastage differentials as at Brunel and Bradford occurred in the 16 colleges on which the NCTA's figures are based, then an even better performance by ONC entrants would have emerged. Only at Brunel were data available for the complete exercise and they showed that where only 9% of the cohort of GCE entrants eventually got firsts, 15% of ONC entrants did. To these figures can be added the percentages getting second-class awards, showing that 42% of the GCE entrants eventually reached honours standard, compared with 59% of the ONC entrances.

Thus there can be little doubt about the ability of ONC entrants in degree-level courses. Their success is due in part to an academic ability at least equal to that of their GCE counterparts, but also in part to their previous educational experiences. Part-time education has given them several advantages. They have had to work largely on their own, and develop self-discipline and the habits of study. Their advantages of the earning and learning tradition also manifest themselves; their experience of industry and the world in general help them to understand the relevance of much of what they are learning and, in sandwich courses, prevented the difficult period of adjustment to industrial conditions that GCE students went through. But the most important reasons are probably their high motivation and the selection process of the ONC course itself. They saw the Dip. Tech. as the logical extension of opportunities in their further education, and were highly motivated to succeed in it. It provided for them the unique vehicle for social and educational advance. This determination was heightened by the difficulty of ONC courses. Only the most able and determined candidates complete this arduous part-time path, so few failed to get an award, and more of these awards were in higher classes than those of the GCE entrants.

By no means were all Dip. Tech. students the frustrated sons of the working class. Students from independent and direct-grant schools accounted for 15% of all students in sandwich courses, particularly in the earlier years. In the CATs there was a tendency for this percentage to decline as they became universities.[3] Marriss found at Northampton CAT that the surprisingly high proportion of public school entrants went there out of indifference to universities other than Oxford and Cambridge: "if these

1. See Table 4.
2. See Table 5.
3. See Tables 6, 7, 8, 9 and 10.

were out of reach, why bother with applications elsewhere, when the college was easier to get into, and offered, perhaps, a more down-to-earth training".[1]

But, perhaps again surprisingly, most of the students on Dip. Tech. courses had been educated at grammer school. Figures from Birmingham CAT show that about a third of entrants that had been to grammar school entered the course by ONC or OND qualifications.[2] It is to this third, together with those from technical and modern schools, that were obliged to leave school without A levels and were unable to get into university that the Dip. Tech. offered degree-level opportunities.

The Dip. Tech. made no significant contribution to sexual equality of opportunity. Neither the NCTA nor the technical colleges appeared to have a great deal of interest in mitigating the almost complete absence of women in engineering in England. Always less than 5% of Dip. Tech. students were female, and these were heavily concentrated in the "other technologies". In 1964, for example, 276 women were enrolled for the Dip. Tech. out of a total of 8,718 students.[3] Of these only 27 were studying engineering, out of nearly 6,000 students. The other 249 joined the nearly 3,000 men in other technologies. The NCTA hoped rather feebly that the first award of the Dip. Tech. to a woman in 1960 would "encourage more women to take up careers in the field of technology".[4] Not surprisingly, their hopes were hardly fulfilled.

As we shall see, the institution of the NCTA offered possibilities for proliferation of degree-level work, because courses could be considered for approval from any technical college, though there was no announced intention to create a better regional distribution of advanced work by means of the Dip. Tech. We shall also see that the creation of another set of institutions, the CATs, acted in the opposite direction, concentration. As peaks of the further education system they attracted better staff, and the creation of separate salary scales meant that they could pay them better wages. Although many of the new recruits came from universities there was inevitably a loss of staff from other colleges. Smaller colleges also had more difficulty than the CATs persuading local authorities to improve their facilities and had courses rejected by the NCTA for this reason. What happened then was that the CATs developed the Dip. Tech. to a great extent, but a tremendous expansion in advanced work in *all* types of courses took place in the other colleges. From 1958 to 1964 the number of advanced students in all further education colleges increased by 186%; in the CATs, by only 30%. The CATs' share of all advanced students increased over this period only for sandwich students from 33 to 41%; for full-time students it dropped from 28 to 18% and for part-time, from 13 to 6%.[5]

In the first couple of years the CATs had a virtual monopoly of Dip. Tech. courses, students and awards. Even by 1964, of over 3,000

1. Marriss P., *The Experience of Higher Education*, London, Routledge and Kegan Paul, 1964, p. 19.
2. See Table 11.
3. NCTA *Report*, 1963–64, pp. 22-23, (see Table 12).
4. NCTA *Report*, 1959–60, p. 4.
5. See section on the CATs.

diplomas awarded up to that time, the CATs had been responsible for all but about 300.[1] A large number of other colleges had courses approved by then, about 20 in all, and distributed in most of the industrial towns of England and Wales (mostly England; Wales had only two) though many of these offered only one or two courses. Within the CAT group, the distribution was very uneven. Two of them, Birmingham and Northampton, were responsible for over a third of the total diplomas awarded by the CATs to 1965. Four others – Loughborough, Salford, Brunel and Battersea – accounted for more than a further third, whilst the remaining four mustered less than 500 (out of over 3,000) between them. Again, four of the ten CATs were in London, and of the 20 colleges mentioned above, four were in London and several more in the counties around it.

To summarize, the NCTA and the Dip. Tech. did make a considerable contribution to equality of opportunity at first-degree level, but with several reservations. The award was not called a degree. There had been a great deal of debate before the creation of the Council as to the possible titles for its award, but the universities were adamant that they and only they could award degrees, and in the end they won. This is not to say that the Dip. Tech. was in practice inferior to a degree. Even the universities had to concede there. But the sense of inferiority nevertheless was present. Opportunity was of course limited to technology,[2] and therefore almost entirely to men. Everybody, the government, the CATs, the NCTA, were complacent about the comparative lack of opportunities for women. Lastly, by introducing to higher education a method of indirect finance — industry-based students — in an attempt to increase resources without cost to the public, the Council allowed priorities to emerge from the free market. This was inconsistent with measures to further social equality and may explain the relatively high proportion of grammar and public school entrants to the courses — they may have been selected by industry for their (superior) social background.

b) *Content and Structure of Studies, Interdisciplinary Approach, Specialization*

The NCTA institutionalized a number of innovations that had undergone sporadic development in technical education over a long period. By far the most important of these were the sandwich principle and the introduction of liberal studies into the engineers' curriculum. A natural corollary of the sandwich principle was the project that final-year students were assigned.

The sandwich principle was by no means new to technical colleges. The first sandwich courses were introduced in the early 1900s, and the HND could be obtained by sandwich study at a number of colleges in 1956 (and still can). But the great achievement of the NCTA was to gain academic recognition for sandwich courses. In its first memorandum it outlined the principles of the courses.[3] It would recognize two sorts of

1. NCTA *Reports*, 1957–59 to 1963–64. Appendix IV (see also Tables 13, 14, 15 and 16).

2. See Table 17.

3. NCTA *Memorandum*, *op. cit.*

courses which it called full-time and sandwich, but both were to include at least one year of suitable industrial training. On sandwich courses the industrial and college periods were taken alternately six months each. In full-time courses, which were more realistically, if less elegantly, known as thick sandwiches, the training was usually taken in one year. There developed a variety of sandwich courses of different configurations at different colleges.

The sandwich principle was created essentially to produce engineers who had an understanding of the practical problems of industry. The charge had frequently been levelled by industrialists that university-trained engineers and even those with external degrees from technical colleges were "chockful of formulae" and theories, but unable to cope with day-to-day situations on the shop floor. The English tradition separating theory and practice still lingered on from the days of the mechanics institutes. It was rife in universities. The sandwich course was seen as the answer to this problem. Experience with it over the years had shown it had several advantages over full-time courses, particularly in engineering. It would produce practical engineers, with experience of engineering problems and the day-to-day developments in industry. Students would be aware of the problems and viewpoints of the people who would ultimately be in their charge, and could examine their own aptitude for engineering in a real situation. At the same time, the relevance of the theoretical studies would be apparent in industry. In short, sandwich courses offered the student an understanding of the industrial environment.

It was apparent within a very short time that the integration of the college and industrial periods was about the hardest problem that the NCTA and the technical colleges faced with the Dip. Tech. The classic work on this was undertaken at Brunel CAT by Marie Jahoda.[1] Students on "thin sandwich" Dip. Tech. courses were interviewed before and after their first college period, and after their first industrial period. The study examined the dilemma which faced the NCTA and the colleges of education (in the sense of development of the personality) and training (simply for skills). It showed that whereas the central aim of the NCTA was to educate technologists (viz. their frequent pronouncements), the central aim of industry was to train them. A compromise position was generally reached: the college period was for education, the industrial period for training, though the training was not meant to be directed towards the needs of one particular firm. The fact that industry was not part of the educational system was the main cause of the problems of the Dip. Tech. training arrangements and assessment of the industrial period were partially at least the responsibility and prerogative of industry and subject to the conditions within industry.

Students' experiences in industry were extremely varied. Less than half the sample found it a good experience, and only just over half expressed a liking for their first industrial period. Subsequent examination of these statements showed them to be unaffected by a number of factors, including performance in examination, age, and salary during the period, and indicated that they were independent statements of the students' experiences.

1. M. Jahoda, *The Education of Technologists*, Tavistock Press, London, 1963.

The form of training the students received was also variable. Five arrangements were commonly found: training schools, which were mostly restricted to engineering; "perambulatory courses", where the student was given experience in more than one department; project work; production work at technician level and production work at workman level.

The biggest single group of students had been given perambulatory courses (35%), but surprisingly few had been to a training school (9%). The 20% who had worked on a project were most enthusiastic about this as a learning experience, and were followed in this by the training school students. Those in "workman"-level work were most unhappy with the period.

During the industrial period, the supervision of the study by college staff was found to be one of the most important influences in the learning process, though in practice a most difficult activity to perform satisfactorily. Jahoda found that the number of supervisors that students had varied, according to the sort of work they were doing. Students with two or three supervisors expressed a greater liking for the period than others. The quality of supervision also varied, and seemed to be related to the occupational level of the supervisor, lower-level supervisors producing poor reports from the student in the period. A similar pattern was found with the responsibility that students were given. Greater responsibility was most frequently associated with a good industrial period.

An important part of Jahoda's study was on the integration of the industrial period in the course as a whole. She found that only just over half the students saw some relation between the first college and industrial periods, but that more of those students that did reported the industrial period as a good experience. In this context, the number of visits from the college tutor was clearly related to the quality of the industrial period.

In another study, Heywood[1] has attempted to evaluate the effectiveness of the industrial training period. The study was based on a postal questionnaire sent to all the diplomates in technology up to April 1, 1962 — about 1,000 in all — of whom about 36% replied, and another to over 700 staff in the CATs directly involved in Dip. Tech. teaching, of whom about 200 replied. The answers showed clearly the confusion over the role that industrial training played in the educational process. Most of the staff thought that it was to provide a general introduction to industry, and the rest that it was either to give a knowledge of the applications of the students' discipline to the problems of industry or more generally to impart the ability to apply scientific method to industrial problems. Students on the other hand mostly thought that its primary purpose was to give them the sort of insight into industry which would help them to select a suitable firm or a suitable department within the student's own firm for future employment. Most of the rest thought it gave an insight into whether to be technologists, but only 7% of the replies suggested that the integration of theory and practice had been its purpose. However, most of the diplomates were satisfied with the periods, and found them interesting experiences.

1. J.Heywood, "The Effectiveness of Undergraduate (Dip. Tech.) Industrial Training", in *Journal of Engineering Education*, Vol. 5, pp. 281–289, Pergamon Press Ltd., London, 1967.

Staff, on the other hand, were more critical and most expressed slight dissatisfaction. Heywood found that the actual conditions of work did not seem to affect attitudes to industrial training, but like Jahoda found that the sort of supervision and amount of responsibility given them was related to the diplomates' assessment of their experiences. On the question of the purpose of the visits by college tutors, the staff were again uncertain. Most assumed its function to be a check that the training was satisfactory, and most others that it was to stimulate the student's thoughts about the job he was doing.

In all, these and other studies show the confused state that the integration of the industrial period into the Dip. Tech. course was in. The issues were far from clear, and the results from the students' point of view not altogether satisfactory. It must be said in fairness that the NCTA had realized from the start that this would be a serious problem. In their first report,[1] they noted "... the Council imagine that few Principals will be in the happy position where students' industrial training provides a precise complement to their academic studies". In 1960, the Council produced a memorandum[2] on the industrial training of Dip. Tech. students after a review of the situation. It reiterated its requirements and outlined the responsibilities of the colleges and the firms. It drew the attention of the colleges to the requirements of the professional institutions for practical training, since many of the students on the courses were hoping to attain professional status, though emphasized again that the colleges should take full advantage of the flexibility of these requirements to ensure integration between industrial training and academic study. The colleges were given the task of making the appropriate arrangements with firms, and ensuring that the students received satisfactory training. The Council took the view that firms co-operating in the scheme would be willing to work within the general framework of the Council's requirements and would collaborate with the college in making arrangements for the period. Assessment of the student's work in the firm was the firm's responsibility, as were the arrangements for supervision. Finally, the NCTA took up the question of visits by college tutors. It emphasized the importance of maintaining contact between the student and the college, and on this point also noted the value of "tutorial days" where the student returned to the college for discussion about the course.

Helpful though this guidance was, it obviously did not clarify the situation sufficiently, for in 1964 the Council's Industrial Training Panel[3] for engineering subjects reported that "the purpose of industrial training as an integral part of courses leading to the Diploma in Technology is far from clear in the minds of either college or industrial staff". It went on to add "this is not surprising in view of the uncertainty that has existed within the Council". It set out to define the objectives of the Dip. Tech. course again. A distinction was drawn between the Dip. Tech. and a

1. NCTA *Report*, 1955–57, p. 7.

2. NCTA, *Memorandum on the Industrial Training of Students following Courses Recognized as leading to the Diploma in Technology*. 1960.

3. NCTA, *Report of the Council's Industrial Training Panel on the Training of Engineering Students following Courses leading to the Diploma in Technology*, 1964.

university-degree course plus a period of graduate training. The main object of the Dip. Tech. with its integral industrial period was to develop the student's operative ability and to fit him for employment in any industrial field. The most urgent requirements of industry were in the fields of design and manufacture, and the Dip. Tech. student had that combination of basic scientific knowledge and practice in its application that suited him particularly for this sort of work. The Panel drew attention to the Fielden Report[1] on Engineering Design which had arrived at similar conclusions. To give the student the appropriate experiences, then, the industrial training period of the course had three main functions. First, it should illustrate the application in practice of the scientific principles that the student had been taught in college, and give him experience of plant processes and materials. Second, it should offer opportunities to meet the sort of problem that occurred daily in industry, and which required solutions based on judgement and opinion, and not to be found in textbooks. Finally, it should give the student experience of all the other factors at work in industry – social, economic and administrative.

To meet the first requirement, a considerable amount of teaching by both the firm and college tutor was essential. An industrial tutor appointed by the firm to each student was therefore necessary. The Panel found the current arrangements far from adequate. College tutors in particular excluded this sort of tuition from their function. To meet the second, the Panel suggested that the project system, which had been successfully developed within the colleges, could be applied in industry, with again the co-operation of industrial staff and college tutors. The students should be given much more scope to examine the wider problems of industry.

The Panel found that there was general agreement that a more objective system of assessment than the present one, which involved occasional reports from firms and tutors, would make the industrial training more purposeful. When this has been properly worked out the inclusion of assessment in the Dip. Tech. classification would be feasible. The Panel also considered the arrangements of the college and industrial periods. It accepted that the course would provide time only for general education and training. To maintain parity with existing degree courses required some 90 weeks in college. To provide time for the various purposes of the industrial period, a further 64 weeks was necessary. The full-time or thick-sandwich course did not fulfil this latter requirement, though it offered some 48 weeks of college vacation, and the Panel suggested that some of this would be sacrificed for industrial training. The normal alternate six-month arrangement also failed to offer the complete answer. Only eight weeks in the four years were vacation, so little scope was offered for experience for staff or students outside the college or firm, and the pressure on students was considerable. The Panel found that the end-on arrangement was the most satisfactory at that time. In this, student intake occurred twice yearly, and industrial places could be maintained continuously, with students changing every six months. This offered time for staff to visit industry for reasonable periods, and helped the development of extra-curricula activities like students' unions.

1. Fielden, G.B.R., *Engineering Design*, DSIR, HMSO, London, 1963.

The second major innovation that the NCTA embodied in its courses was the requirement that they should all include liberal studies and instruction in the principles of industrial organisation. Like the sandwich principle, liberal studies were not an innovation at every college, though again the NCTA was the first body to establish it as an essential part of a course at this level. This requirement was consistent with the general policy of the NCTA to produce technologists able to adapt to a variety of conditions in most branches of industry. The Panel on Industrial Training (see above), for example, saw clearly the relationship between its third objective of industrial training, to acquaint the student with the general problems of industry, and the liberal studies courses at college, and it called for close co-operation between college departments and firms. Part-time courses had been hampered in the development of this sort of subject by shortage of time. The Dip. Tech. provided opportunity to incorporate them during the undergraduate course, rather than leaving them to chance, the student's own initiative or post-graduate courses in management.

Much of the debate about the value of liberal studies was concerned with communication. It was frequently held against engineers that, good as they might be at making things work, they were unable to present in spoken or written English a reasonable account of their activities. There was probably a strong element of truth in this. Apart from university graduates, engineers generally acquired their qualifications by part-time study. They usually left school as soon as possible, and the rigours of the part-time route offered little opportunity for studying extraneous subjects. Another major advantage of liberal studies was claimed to be breadth of outlook that a study of a number of other disciplines induced. Lastly, it was argued that such subjects as economics, social science and philosophy were of direct relevance to the engineer in his job, as they dealt with institutions, people and problems that the engineer encountered daily.

Ranged against these arguments was the tradition from the earlier days of the Industrial Revolution that engineers should be trained for the job and nothing else, a tradition that still held sway in many educational institutions after the Second World War.

For the NCTA, at least, the case was clear enough. Liberal studies were an essential component of the education of engineers, and colleges had to submit in their syllabuses a regime of liberal studies. This development of liberal studies took place in a number of ways.

Many colleges provided basic courses in English, and it is a depressing indictment of English primary and secondary education that they were found to be both necessary and welcome. Social studies were important, as was industrial administration. Courses in social studies included economics, economic history, geography, British life and institutions and international relations. Industrial administration included industrial relations, industrial law, economics, aspects of industry and human relations. Some colleges allowed students to choose such subjects as art, music or literature for special interest. Surprisingly, few colleges made the fundamentals of science an essential feature of the liberal studies course, and at Brunel, for example, Jahoda reported it as something of a breakthrough.[1]

1. Jahoda, *op. cit.*, p. 89.

There was considerable debate within colleges on the function of liberal studies within the Dip. Tech. course. Most rejected the idea that the introduction of specialized subjects like art, music or philosophy would "liberalize" the student, but integrating liberal studies within the course was as difficult as industrial training. Jahoda found that the fundamentals of science courses were greeted with considerable enthusiasm, indicating again a sad omission in the schools. Social studies met a moderate response, about half the sample offering positive comments, but English was not so favoured, with only a third of students giving positive comment.

The third significant feature of the Dip. Tech. course was the project in which each student was to participate. This project was compulsory and in addition to any project work the student may have done during an industrial period. This too was introduced to give the student an understanding of practical problems, and to help him to see how scientific principles could be applied in a practical situation. Some five or six hours each week were devoted to the project in the final year of most courses, although the student was expected to have given the matter some thought during the previous three years. By the beginning of the final year, the student was generally ready to start on experimental work, and this lasted for most of the final college period (on thin-sandwich courses, that is). The results were then written up by the student in the form of a short thesis. The topic was selected either by the supervisor or tutor, taking account of the student's interests, or by the student himself. It sometimes arose naturally out of experience during the industrial training period, and if it did, integration of theory and practice was achieved. Many students felt that this was one of the most fruitful experiences during the course.

The introduction of these innovations by the NCTA did not present as serious difficulties for technical colleges as similar innovations would in universities. For one thing, the ideas had arisen out of a long tradition. For another, the technical colleges had traditionally met fluctuating needs, and were used to change. Interdisciplinary studies posed few problems of rivalry: there were few faculties of arts jealously guarding their secrets in the technical colleges of 1956. But the introduction of a sandwich course of this length and level did pose problems. As we shall see below, many of the courses proposed by the colleges in the early years were rejected by the NCTA for lack of facilities and inadequacy of staff. Colleges had to adjust to a new way of teaching, involving more tutorials and private study, and to a closer liaison with educational personnel in industry than previously. We have seen the difficulties that this caused. The introduction of thin-sandwich courses on a six-month basis put a considerable strain on staff and students alike. Liberal studies were much more of an innovation, and the problem of their relation to the rest of the course was exacerbated by the inexperience of staff with this sort of subject, and sometimes by their own opposition to it.

More generally, the Dip. Tech. allowed colleges to offer a much wider range of curriculum than before, either with external degrees or HNC or HND courses. The examination system, though still rigorous, helped to reduce wastage to levels below these courses. It was possible to refer students who failed in one or two subjects to take these examinations again, unlike the practice in HNC courses for example, where all examina-

tions including practicals had to be passed before the student could proceed. The curriculum was entirely the responsibility of teachers, and it was generally kept more up-to-date than those laid down by London University or the Joint Committees that administered the National Certificates and Diplomas. Thus new subjects were introduced into technical colleges before they reached universities. The CATs, for example, developed undergraduate level courses in production engineering and computing and electronics, when provision in universities for these subjects was at post-graduate level or not at all.

The best measure of the success of the Dip. Tech. course must be the regard for the diplomates in industry. Here there is some ground for congratulation. Industrialists certainly seem to appreciate the distinctive characteristics of Dip. Tech. graduates and there was concern among industrialists when it was announced that the CATs were to become autonomous universities, following the Robbins Report, that they would abandon the sandwich principle.[1]

In their evidence to the Robbins Committee, the Federation of British Industries said "we welcome the steady increase in students who have enrolled for the Diploma in Technology course... As the course becomes increasingly well established, it appears likely that manufacturing industry will demand more college-based students from the Colleges of Advanced Technology than there are available, and will recruit more men as works-based students".[2] (Note the reference to recruiting *men*). Although the original intention had been for holders of the Dip. Tech. to the production side of industry, a depressing feature of the employment of diplomates has been the number choosing to stay within the academic community to do research or to teach. In the ten CATs alone in 1966 there were 72 holders of the Dip. Tech. in full-time teaching posts, and there were others as post-graduate students though we have no figures for these, nor for holders of the Dip. Tech. working in other universities or colleges. In industry too, not all the Dip. Tech. men went into the production side. To quote James Tait "they have in fact often turned out to be valuable members of research and development departments or teams".[3]

One of the problems that beset the NCTA with the Dip. Tech. course was student wastage. This can perhaps be taken as another measure of the success or failure of the innovation. There seems to be little doubt that the Dip. Tech. courses did have a higher wastage rate than university first-degree courses, though much of the debate on this subject took place in the light of rather inadequate statistical information. Looking at the annual totals of students over the four years of courses, figures were produced that showed something like 40% of entrants failed to get a diploma. The NCTA conducted one or two analyses of its own, which showed varying results. The one published in their 1964[4] annual report showed a failure rate of 31% for 1st year entrants in 1959–60, and entrants direct to the second year in 1960–61. This was a similar figure to the one published in the pre-

1. "In pursuit of Sandwiched Learning", *Engineering*, 22nd May 1964, p. 3.
2. *Op. cit.*, Evidence, Pt. I, Vol. B, p. 575.
3. Tait, Dr. J.S. "Sandwich courses — The Opportunity and the Need". *Quest*, May 1967, p. 5, City University.
4. NCTA *Report*, 1963–64, pp. 8-10.

vious year,[1] which related to students entering in 1956–58. Here 30% of the entry failed to get an award. This was unusual because the figures were taken on different bases. The first set include an estimate (rather generous) for awards to students still on the courses. The second does not. In the same report, the Council included the results of the FE wastage survey conducted by the Ministry of Education and used by the Robbins Committee.[2] This gave a wastage rate of 37%, and showed that it was higher in CATs (40%) than in regional colleges (25%).

We have been able to obtain figures from several of the CATs[3] on wastage, and they show that it was around this level. At the CAT Birmingham (now University of Aston), the wastage for 1961 and 1962 entrants including successes of repeating students were 33 and 31% respectively. At Bradford CAT (now University) for 1961 and 1962 entrants and on the same basis the figures are 25 and 34% respectively. At Brunel CAT (now University) for entrants from 1956 to 1960, 33% failed to complete the courses. The Robbins Report showed that university first degree courses had lower wastage rates than the Dip. Tech. Courses,[4] the figures were 21% in technology and 15% in science.

The influence of examination arrangements on wastage cannot be ignored here. The NCTA required that "arrangements satisfactory to the Council[5] should be made for testing the progress of students at suitable intervals", and this invariably meant examinations every year. Robbins showed that wastage occurred each year on the Dip. Tech. course[6] 15% in the first, 11 in the second, 8 in the third and 3 in the fourth. It was more evenly spread than on a degree course, where almost half the wastage occurred in the first year.[7]

The NCTA's determination that its award should be comparable in standard with a university first degree led it to set very high standards for approval of courses. Its first memorandum outlined conditions not only of curricula, admissions and examinations but of college and other facilities. The college was as a whole expected to provide a substantial programme of advanced work, and the subjects constituting the Dip. Tech. course were to be carried out in an environment where advanced studies were the main preoccupation of the staff. The college was also expected to provide good library and social amenities. Adequate facilities for private study by students were singled out for attention. A number of other conditions, for residence and quality of staff are dealt with under their respective headings below. The difficulty that the colleges had in meeting the standards set by the NCTA shows one of the main problems that innovation in existing institutions creates.

Although the Council set high standards in the early years, it frankly admitted that many of the colleges were unable to meet them, and that

1. NCTA *Report*, 1963–64, pp. 8-10.
2. *Op. cit.*, Appendix Two (A), Part IV, Table 43.
3. See Tables 4, 5 and 18.
4. *Op. cit.*, Appendix Two (A), Part IV, Tables 41 and 42.
5. NTCA, *Memorandum on the Recognition of Courses in Technical Colleges Leading to the Diploma in Technology*, 1955, p. 6.
6. *Op. cit.*, Appendix Two (A), Part IV, Table 41.
7. *Ibid.*

some courses were approved on the basis of plans in hand or proposed.* What this says for the colleges whose courses were rejected at this period is left to conjecture.

These NCTA requirements thus prompted developments in a number of ways. Libraries in particular were inadequately equipped at most colleges (one CAT had no library at all) and there were few opportunities for private study by students or for the introduction of tutorial teaching methods. But by 1963, the Council had to report that it found many of the building plans proposed by the colleges had failed to come to fruition.[2] The colleges were often exploiting every square foot of space to accommodate the staff, students and equipment for Dip. Tech. courses so in one case for example, recognition of a course was renewed with a strong rider about the urgent need for new buildings. Colleges wanting to develop in a particular direction were often restricted by local authorities not wishing to treat their colleges unequally.

But despite the difficulties, the development of Dip. Tech. courses in technical colleges did prompt a lot of building and the purchase of equipment for work at this level. Technical colleges have always seemed to be bursting at the seams, so it is difficult to say to what extent the introduction of the Dip. Tech. influenced the better utilization of space. As we have seen, every effort was made to fit the courses to existing and already cramped buildings. Development of new buildings was under the aegis of the DES and is mentioned elsewhere.

The peculiarly flexible nature of the arrangement governing the creation of courses for the Dip. Tech. meant that the choice of subjects for courses was left to the college itself. Thus, the question of specialization of institutions resided almost entirely outside the sphere of influence of the NCTA. The only restraint on proliferation that the Council imposed resulted from its requirements in terms of facilities, level of work and quality of staff. Each college could obviously not fulfil the requirements in every subject. Battersea, Birmingham, Bradford, Northampton and Salford CATs ,were all offering Dip. Tech. courses in nine subjects in 1964. On the other hand, seven of the other colleges were offering only one course each.[3]

Factors operating outside the NCTA were various, and will be dealt with elsewhere. They included the Regional Advisory Councils whose main function was to co-ordinate courses on a regional basis, the Ministry, the whims of LEAS and the colleges themselves, largely governed by their response to local social and industrial demands.

The NCTA was of course limited by its Trust Deed to technological subjects. It took a fairly broad view of technology, and courses in maths, statistics and applied biology for example were approved for the award of the Dip. Tech. The creation of the CNAA (see below) allowed a much greater range of subject.

1. NCTA *Report*, 1955–57, p. 9.
2. NCTA *Report*, 1962–63, p. 4.
3. NCTA *Report*, 1963–64, List No. 16.

c) *Organisational Structures, Institutional Autonomy, Administration and Management*

Throughout this paper we have seen that it was the intention of the NCTA to ensure maximum academic freedom for colleges awarding the Dip. Tech. commensurate with the maintenance of standards. This was done by arrangements similar to those that had been in use for many years in the national certificate scheme. Under the NCTA's Trust Deed, two Boards of Studies were set up,[1] for engineering and other technologies, to examine the colleges' proposals. Their duties included consideration of the curricula and syllabuses put forward by the colleges, the qualifications of the teachers and physical provision at the colleges, according to the standards set by the NCTA in its memorandum. The Boards consisted of representatives of teachers in technical colleges, professional institutions and members nominated by the Minister of Education to represent other fields including industry and the universities. In 1958 and 1961, amendments were made to the constitution of the Boards, the most important of which was to include the Committee of Principals of the CATs with the teachers' organisations which nominated teacher members of the Board, largely in recognition of the substantial contribution of the CATs to the development of the Dip. Tech.

The Boards of Studies were responsible to and subject to the control of the Governing Body of the Council. The Chairman of this was appointed by the Minister, and there were 11 other members. Five of these were appointed by the Minister, four distinguished in technology and one in local government administration, and three were from each of the Boards of Studies, one of which in each case was a teacher. Again in 1960, when it became obvious that the CATs were providing the bulk of the courses leading to the Dip. Tech., the constitution was amended to include three principals of the CATs on the Governing Body, and one principal of another college.

The Boards of Studies each set up Subject Panels to deal with individual technologies. These consisted of Council members with other members co-opted for their specialized knowledge, and on each, one of Her Majesty's Inspectors served as assessor. When a college was seeking recognition of a course, it submitted to the Council details of the proposed entry qualifications, teaching staff, curriculum, syllabus and industrial training. These were examined by the Subject Panel concerned, and members of the Council visited the college to see facilities available, and to discuss with staff and students any points arising from their examination. If the college was thought to be suitable for conducting Dip. Tech. courses in general, then the visiting party and Subject Panel arrived at a decision about the course in question. Their recommendation was referred to the Governing Body, whose decision in turn was conveyed to the college. If a course was rejected the college was told of the principal reasons, and informed also if it was likely that the decision could be reconsidered after revision of some arrangements. But the essential point was that the colleges created the courses. The NCTA was only concerned with the level of the course and with the facilities at the college. However, whilst academic

1. NCTA, *Memorandum on the Recognition of Courses, op. cit.*

freedom was a major concern of the NCTA, institutional autonomy did not come into its field at all. The method of government of the colleges was left in the hands of the Ministry. The CATs of course were given somewhat greater autonomy than the other technical colleges, so that they could develop into national institutions with many of the attributes of universities. The NCTA had no control over the subjects that the colleges offered courses in, except that its own courses had to be technological. This was left to the prevailing forces, a combination of the Regional Advisory Council's social demand, industrial demand and national needs.

Where there was large scale adoption of the sandwich principle, certain administrative rearrangements became necessary. The thick sandwich presented rather fewer problems in this respect, because it worked on the basis of the traditional academic year. Thin sandwich courses were organised generally on two bases, either straight six-month alternating periods in college and industry or end-on courses, where student intake occurred twice yearly, and facilities were utilized throughout the year, both in industry and college. Other arrangements (such as the thin sandwich with a full final year in college at Brunel) were found less frequently but presented similar problems.

The end-on arrangement was quite an innovation in English higher education. The traditional academic year starting in September or October was abandoned in favour of the semester, of about five months' duration; running from September to February and March to July in most cases. The academic year was thus slightly longer than before, and this has put staff under some strain. But it does have the advantage of more even use of buildings and plant, a very important consideration when dealing with expensive engineering equipment, and offers industry the opportunity to maintain training facilities throughout the year. Industry's attitude has been equivocal: despite the enthusiasm for the Dip. Tech. course, the response to the end-on arrangement has been disappointing and there have been complaints that it is failing to take full advantage of the system.[1]

The introduction of liberal studies into the curriculum of the colleges did not cause any serious interdisciplinary readjustment at first. In many cases it simply meant the modest expansion of a small department. But as the broad interdisciplinary approach of the Dip. Tech. course developed in the colleges, their interest developed into other fields: here is genesis of new social science departments. The establishment of the department of psychology at Brunel for example owes a great deal to the influence of the Dip. Tech. The huge department of industrial administration at the CAT, Birmingham is another example. The rather broader concepts of the NCTA encouraged can be seen to have taken root in the arrangements at the technological universities, the former CATs. Several of these are organised on a School basis, and courses generally involve the student in subjects selected from several schools. Many of the degrees of these universities are in subject or subject groups new to the university world. Economics with Technology at the City University, and joint honours courses at Salford are examples.

1. Tait, *op. cit.*, p. 6.

d) *Recruitment and Status of Teachers*

The quality of teaching staff was one of the conditions that approval of courses for the Dip. Tech. by the NCTA depended upon. The first memorandum of the Council was quite insistent in its requirements here.

> "The staff will be expected to be of high quality. In particular the leaders of each branch of study should have either higher degrees and substantial academic experience, or suitable academic qualifications supported by substantial industrial experience or both. They should also be professionally active in their subjects.
>
> It is highly desirable that colleges and industry should arrange their conditions of employment so that interchange of staff for suitable full-time periods can be encouraged.
>
> In assessing the staff the emphasis will be on their intellectual and personal qualities. They should include persons to whom industry would go for advice. Above all, they will be expected to be good teachers and be able to relate their industrial experience to their teaching work ".[1]

In many cases this was asking rather a lot of the technical colleges and the rejection of many courses in the early years was due to the inadequacy of staff. The designation of the CATs and the creation of separate salary scales for their staff meant that they were more able than other colleges to make good their deficiencies, so to this extent it acted to prevent proliferation of the Dip. Tech. It is important to note that the NCTA made no specific requirements for qualifications. Industrial and other experience was considered as valuable as academic qualifications, even at the level of "leaders of each branch of study". This gave many people in industry the opportunity to teach in technical colleges, and gave the college the benefit of teaching staff with practical experience in their subjects. But the high standard set by the NCTA did mean that academically highly qualified staff were often more likely to get jobs in the colleges. In the CATs in particular, with improved salary and promotion prospects, an increasing number of staff had first and higher degrees and came from universities.

But the NCTA frequently had cause to remark on the quality of staff.[2] In particular it found the number of recruits to engineering disappointing. The difficulty that colleges had in attracting suitable staff is shown in the time that some vacancies were left unfilled. This occurred most noticeably in the higher levels. Headships of departments, for example, at the CAT Birmingham remained vacant for two years. In some cases these difficulties were not helped by the policy of the college's governing body, and the Council were able to offer guidance on this subject. Comments by the Council on the reluctance of some staff to engage in research cast some doubts as to their ability to do creative work. Even in the later years of the Council's existence it was rejecting courses because of the inadequacies of staff in colleges.

1. NCTA Memorandum, *op. cit.*
2. NCTA *Report*, 1963–64, p. 6.

e) *Teaching and Research*

The NCTA was concerned with research in two ways: first in relation to teaching, and second in respect of its own higher award, the Membership of the College of Technologists (MCT).

It regarded as essential that teaching staff on Dip. Tech. courses should have opportunities for research. In its evidence to the Robbins Committee it was able to report the progress that had been made in this direction.[1] It reiterated the belief that "a department can be fully effective in conducting courses leading to the Diploma in Technology only if members of the staff of the department are contributing to the advancement of knowledge in their subjects". The close links that technical colleges had with industry meant that there was a wide field in which post-graduate courses were organised, and to undertake these colleges needed staff fully conversant with developments in their subjects both in research and in industry. It had found the provision in many of the colleges for this sort of research very poor in the past, though it varied considerably between colleges. But there was some improvement. Timetables were being readjusted and facilities increased to enable staff to spend more time in their research. The Council felt that much of this had been the result of its policy not to recognize a course unless the college intended to provide adequate facilities for staff research or other creative work.

When the NCTA was established, higher degrees were available in technical colleges for the most part only to holders of London University degrees. In 1958, the Council created the MCT. This award it hoped[2] would encourage holders of the Dip. Tech. as well as of university first degree to undertake research problems directly related to the needs of industry. It also wished to encourage teachers in technical colleges to work for the award.

The MCT was to be broadly equivalent in standard to a Ph.D., and take about as long, that is about three years, but have several characteristics that distinguished it from the university award. The close connection with industrial problems was one and another was the requirement that the work should be carried out jointly in industry and college. Part of the time spent in college could be spent on an advanced course, but the Council was at pains to point out that it did not intend to institute an award solely for course work. They did not want substantial numbers of Dip. Tech. students to go on to a further course as a normal procedure. Their place was essentially in industry. Responsibility for matters relating to the award was delegated to a body established by the NCTA called the College of Technologists.[3]

The MCT failed to get off the ground. Enrolments were far from spectacular. By 1964 only 106 candidates were registered as studying for the award and only 3 awards had been made by that time. Of this 106, only 26 were holders of the Dip. Tech., 37 were graduates from universities and

1. *Op. cit.*, Evidence, Pt. I, Vol. B, pp. 682-709.
2. NCTA, *An Award Higher than the Diploma in Technology*, 1958.
3. NCTA, *Memorandum by The College of Technologists on the Awards of the Membership of The College* (MCT), 1959.

the rest had equivalent professional qualifications.[1] This must be compared with the 53 Ph.Ds of London University that were gained by people in the CATs in 1964 (to say nothing of the 58 M.Scs.).[2] Nevertheless the NCTA was "encouraged" by the response because of the demands that the work made on both college and industry. Close co-operation was essential between these two in order that proper thought could be given to the organisation and supervision of the student's work.

Overall the NCTA directly influenced both the staff student ratio, by insisting on additional staff before approval of courses, and the pattern of teaching. One of its conditions for approval was the provision of facilities for private study for students, and for separate staff common rooms and work rooms.

Residential facilities were another of the Council's requirements before approval. It regarded them as a means of generating a sense of academic community in students, and of facilitating staff – student contacts. It was on this matter that it had most cause to complain over the inadequacy of the provision at colleges. Even in 1964, the Annual Report of the Council contains a reference that "the provision of halls of residence still falls far below what is required ...", though it expressed interest in the way that two colleges had been able to by-pass the building programmes of the DES in financing halls of residence. Loughborough was the only college that had substantial residential facilities, which had been acquired (by a variety of means) since 1918.

f) *Higher Education and the Outside World*

It is perhaps under this heading that the greatest contribution was made by the NCTA. For the first time in the history of higher education an institution was created specifically to respond to the requirements and demands from bodies in the outside world, and to administer an award of national currency at first-degree level in direct response to these demands.

The Diploma in Technology was not only an award devised to meet the needs of "students who preferred direct entry into industry or into courses different from the normal university pattern",[3] but to meet the needs of industry for increased numbers of technologists of this particular type. Colleges were left free to plan courses with industry and in response to industrial needs.

Co-operation with industry by the colleges was maintained in a number of ways. At the highest level, the Governing Body of the NCTA had several eminent industrialists as members and its Chairman has always been a captain of industry. The Constitution of the Boards of Studies ensured that industry was represented, and the Subject Panels drew heavily on industrial personnel for their specialized knowledge. There was a good response from industrialists to requests for their services on Subject Panels.

1. NCTA *Report*, 1963–64, p. 11.
2. *Statistics of Education, 1964*, Pt. II, Table 24.
3. Robbins Report, *op. cit.*, p. 682.

In the colleges, collaboration was secured for example by the appointment of industrialists to college governing bodies, and many colleges set up advisory boards of college staff and representatives of firms supporting courses. External examiners were frequently drawn from the industrial field. The integration of the industrial training periods into the course was one of the activities that called for the closest co-operation between college and industry. This resulted in frequent meetings of industrial and college personnel. College tutors visited students in their place of work, and representatives of firms visited students during college periods. One college was reported [1] to be encouraging firms to appoint one of their own staff as industrial tutor to the student during his industrial period. These activities were not only to the benefit of the student. Industrial staff were kept informed of current academic research, and academics of recent industrial developments. We have already noted the higher award of the NCTA, the MCT was also specifically designed to be directly related to industrial problems, and to encourage college – industry collaboration. In Section h) we will see the extent to which financial co-operation between industry, the colleges and the LEAS took place.

It is difficult to say to what extent the NCTA precipitated the development of special short courses or refresher courses for industrial personnel. Certainly a large and growing number of these was held during the NCTA's existence, but it had always been a function of technical colleges to provide this sort of service to industry. It would not be unrealistic to suggest however that the new spirit of co-operation fostered by the NCTA was responsible for the development of many of them. Except for its considerable function to extend already existing further education facilities, the NCTA was not concerned with adult or continued education *per se.*

g) *Evaluation and Planning*

The NCTA established very little machinery specifically for the evaluation of courses as they proceeded. True, the courses were thoroughly examined before they were approved by the Council for the award of the Dip. Tech. and this approval had to be renewed every five years. Consultation and discussion were always possible between colleges and the Council, but relied on the college for their initiation. And the Council had very little information on which to base any evaluation. Statistical material collected by the Council was always very sparse. There were only five tables (of three or four lines each) on students even in the 1964 report.[2] It was not until 1961 that any details of the method of entry of students were published by the Council, yet this was one of the most important things that distinguished the Dip. Tech. from comparable awards. Even this had to be prompted by Parliamentary questions in the previous years. When the Council did decide that it should make a serious attempt to see where it was going, it was generally only after debate on the subject had reached a high pitch. It was then of course hampered by lack of information. When the debate on wastage was raging, the Council was obliged

1. Robbins Report, *op. cit.*, p. 688.
2. NCTA *Report*, 1963–64, pp. 22-24.

to write frantically to external examiners asking for reasons why wastage was so high. Again, the major study on the Dip. Tech. was conducted entirely outside the Council, by Jahoda at Brunel CAT. It was not until 1964 that the Council's industrial training panel reported on the crucial question of industrial training of sandwich students.

The situation with respect to planning was slightly different. The Council wanted to preserve the tradition of flexibility to demand that technical colleges have always exhibited, so that planning *per se* was not its function. Developments took place as a result of "market" forces, external to the NCTA and to some extent to the colleges. This system relied, however, on a very substantial factual basis to make decisions. Supplying this was a role that the Council might well have thought fit to fulfil, occupying as it did a central position in the college-industry-student system. It does not appear that it did undertake this role, but chose instead to remain simply the arbiter of standards for courses.

h) *Cost and Financing*

Much of this topic is discussed under the section on the CATs. The Dip. Tech. did introduce, however, a particularly interesting financial arrangement to the higher education scene, the "industry-based" student. In this arrangement the student was generally a student-apprentice selected by the firm in co-operation with the college. The student was generally paid full wages throughout the course including college periods, and the firm usually paid college fees in addition. The firm generally expected the student to return to his employment after the course, but rigid restrictions were not usually imposed. Other students were called "college based". They were selected by the colleges, who arranged their industrial training for them. These students were generally financed by local authority grants during the college period and paid wages by the firm during industrial periods. Sometimes firms would offer college-based students a student apprenticeship after they had seen their performance during the first industrial period. The NCTA saw a continuing need to provide for college-based students.[1] This arrangement offered the student a wider choice of career, and many firms though willing to provide training places for courses in certain subjects were unable to go to the expense of financing industrially based students.

The NCTA and colleges as a rule found no shortage of firms offering industrial training places, though there was some difficulty in placing students. In 1964 the Principal of Northampton CAT was quoted as saying that some companies were unable to fill all their training places.[2] But when it came to financing industry-based students the situation was a little less encouraging. As early as 1958, a joint statement was issued by the Minister of Education and the Federation of British Industries, which although encouraging firms to continue and expand their support for industry-based students, recognized that a continuing number of students would look to their local authority for grants. The statement announced the issue of a

1. NCTA *Report*, 1962–63, p. 7.
2. "In pursuit of Sandwiched Learning", *op. cit.*

memorandum[1] recommending LEAs to give sympathetic consideration to these applications. Though the number of industry-based students increased yearly, there was some reason for concern. From 1963 to 1964, for example, while industry-based students increased from 4,700 to 5,400 the percentage that was wholly financed by industry decreased from 80% to 60%. This was the result of an actual numerical decrease from 3,765 to 3,279 students wholly supported by industry.[2] This caused the Council no small concern, but was only one of the problems that resulted from this method of finance. Other problems were perhaps more serious as we have seen. The use of this device to increase financial resources to education by direct contribution from industry inevitably implied a certain shift of priorities from entirely educational to those existing within industry. For example, "education of technologists" to industrialists more often than not meant "training", as Jahoda showed. However, good co-operation existed between the colleges or the NCTA and industry, it was very difficult for the former to delegate specific educational functions to personnel in industry, when, after all, it was industry that was providing not only the time and premises, but paying the students' fees and wages as well.

i) *Council for National Academic Awards (CNAA)*

We have not undertaken complete analysis of the innovations and performance of the CNAA because many of the institutional structures and educational practices of the new Council are based partially or entirely on those of the NCTA so that it would be repetitious. The section attempts to show the contribution of the NCTA to the creation of the CNAA and to outline the ways in which they differ.

In 1963, the Robbins Report recommended that "the National Council for Technological Awards should be replaced by a Council for National Academic Awards."[3] The Council (unlike the NCTA) would cover the whole of Great Britain, and would be empowered to award degrees in all subjects to students in colleges of further education. The Committee had established as a guiding principle[4] that equal academic awards should be available for equal academic performance, and this appeal to justice, together with the further recommendation that legislation should be introduced to prevent unauthorized bodies from awarding degrees, eventually released the universities' hold on degree-giving powers. The Committee found that the system adopted by the NCTA had proved itself, and that there was a need for this sort of course in other subjects. As the Committee was also recommending that the CATs should become autonomous universities, a body with power to award degrees was needed for the other colleges in the further education system and this was to be the function of the new Council.

The CNAA received its Royal Charter on the 10th September 1964. The principle of external assessment of courses created internally was

1. Ministry of Education, Administrative Memorandum No. 567, 29th April, 1958.
2. NCTA *Reports*, 1962–63, p. 7 and 1963–64, p. 8.
3. *Op. cit.*, p. 283.
4. *Op. cit.*, p. 8.

paramount. It owed a great deal to the NCTA: two Boards of Studies were set up to deal both with Science and Technology and with Arts and Social Studies, on similar lines to the NCTA's, and composed of representatives of the colleges, industry, commerce and the Department of Education and Science.

Under these were subject Boards whose members included some with specialized knowledge of the various subjects. Statement No. 2 by the Council outlined the conditions for the approval of courses. These were basically those which had grown up under the NCTA; the Council said, "while these requirements were framed by the National Council for Technological Awards with sandwich courses in mind, the general standards implied in them are equally applicable to courses leading to the Council's degrees".[1] With very little modification, these have remained the Council's conditions for approval of courses. The same statement also announced the titles of the Council's first degrees – Bachelor of Arts (B.A.) and Bachelor of Science (B. Sc.). Their structure differed from the Dip. Tech.; there were to be three honours classes, and pass awards would be given only in exceptional circumstances. Students already on courses leading to the Dip. Tech. could receive either that award or the Council's B. Sc.; those who already held the Diploma were entitled to a retrospective award of a degree: a pass level Dip. Tech. would be equivalent to a third-class honours degree. The Council later extended its field to ordinary and higher degrees. The ordinary degree was intended to be a qualification in its own right, "not for indifferent performance on honours courses",[2] and it arose out of a suggestion in the Robbins Report. Robbins indeed went so far as to say, "a new range of pass degrees would soon render the Higher National Diploma superfluous".[3] Unfortunately, insufficient time has elapsed to test this prediction. The CNAA's Ph. D. award took over where the ill-fated MCT left off (with more success), but the Council also ventured into post-graduate courses for its M.A. and M.Sc. awards.

Entry requirements for courses, too, were much the same as for the Dip. Tech., that is at least five GCE passes with two at A level, or good ONC and OND or equivalent. Flexibility was important, and the Council were anxious not to exclude worthy students.

By September 1968, courses had been approved at nearly 50 colleges. They included regional and other technical colleges, colleges of education and other further education establishments. Most of the colleges were under the control of local education authorities, though some were national colleges and others Service colleges. Already, CNAA degrees were available in more colleges than the NCTA's awards had ever been. Four of the colleges were in Scotland and one in Wales, so there was somewhat more proliferation than the Dip. Tech. had achieved. There were over 200 recognized courses in these colleges, with a wide range of subjects. A great deal of imagination had obviously been applied by the colleges to the creation of the courses, though the Council expressed concern at the high rejection

1. CNAA *Statement No. 2*, April 1965.
2. CNAA *Report*, 1965–66, p. 9.
3. *Op. cit.*, pp. 141–142.

rate, particularly in arts and social sciences.[1] This was mainly due to the level of staffing in colleges, aggravated by national shortages in these fields. As with the Dip. Tech., a number of courses were in subjects that had not yet reached the universities, such as building economics, estate management and photographic technology. Some of the courses ventured into interdisciplinary studies, such as commerce with engineering. The form of courses also varied, full time, sandwich and (something the NCTA was unable to do) part time. The colleges retained their enthusiasm for sandwich courses, and the principle has now been applied to a number of disciplines outside traditional science and engineering, including estate management, business studies and social science. The B. A. Social Science course at Enfield College of Technology, for example, lasts four years. The first two years are full time, and constitute Part I of the degree, and the second two are sandwich. The college is experiencing some difficulty in placing the students for their sandwich periods, but most spend it in industry, local authorities or government services. Only five part-time first-degree courses have been approved by the Council to date, though more are expected.[2] One of these is in Mathematics at Hatfield College of Technology and the other in Social Science again at Enfield. The latter is of particular interest as it is intended for qualified school teachers. At post-graduate level there are part-time M.Sc. courses at Northern Polytechnic and Sir John Cass College.

Numbers on CNAA courses have risen quite spectacularly. Despite the loss of students on courses in the CATs, there were in September 1968 over 15,000 students on courses leading to the Council's degrees: at the beginning of 1965 there had been only 3,000. This growth shows the extent to which there were potential degree-level students outside the universities, and illustrates the ability of the further education system to cope with rapidly increasing numbers. Most of this 15,000 were in science and technology, carrying on the momentum of the Dip. Tech., but nearly 4,000 were in Arts and Social Science, where there had been none at all in 1965. The widespread acceptance of the sandwich principle is clearly seen here. Over 10,000 students were on sandwich courses.[3]

What was the contribution of the NCTA and the Dip. Tech. to all this?

Educationally, the NCTA established its several innovations once and for all as valid and valuable educational principles at first-degree level, and set the scene for their extension, not only to higher degrees, but also to fields other than science and technology. The sandwich principle has been accepted for the education of engineers and scientists, but most of the claims made for it are still valid in social sciences and business studies. In commerce as in industry, experience of and responsibility in practical situations are of great value to the student. The modest, often faltering attempts of liberal studies departments to give broader education in the Dip. Tech. are coming to fruition in the development of interdisciplinary courses for the CNAA's awards. Nevertheless, the growth of single discipline courses

1. CNAA *Report*, 1966–67, p. 8.
2. CNAA *Report*, 1967–68, p. 11.
3. *Ibid.*, p. 38.

continues: it is hard to see why, for example, engineering remains so distant from economics in most colleges.

More generally, the CNAA has inherited most of its institutional structures from the NCTA. They have the same Chairman and similar Boards of Studies and Subject Boards. Industry and the professional institutions are strongly represented. The same system for approval of courses has been adopted, allowing the college the maximum freedom to create courses commensurate with the maintenance of academic and physical standards. It was the NCTA that established this as a valid procedure at this level. As with the Dip. Tech., courses can arise out of local needs, to meet social and industrial demands. The CNAA has continued with the practice of admitting ONC and OND candidates to higher education, and has made more effort than the NCTA to enrol another group that would have been deprived of higher education, mature students. The climate of opinion on this subject is changing now even within universities. The CATs carried the idea of ONC/D entrants into the university sphere as a serious proposition for the first time. Now London University is to admit these candidates. And there is obviously still a great need for this. In 1968, a quarter of entrants to CNAA courses had qualifications other then GCE.[1]

Crucial in the minds of most people in the further education system however has been the lack of a further education award at first-degree level *called a degree.* In their evidence to the Robbins Committee,[2] the Association of Teachers in Technical Institutions said, "the prestige of institutions dominates higher education.. Where a student has a choice between a University degree and a Diploma in Technology he invariably chooses the former... It is... of major importance that steps should be taken to raise the prestige of technical education. Much has been done in recent years by the creation of the Colleges of Advanced Technology and the recognition of the Diploma in Technology as equivalent in status to a university degree. Much more could be done to accelerate this development by giving the Diploma in Technology degree equivalence in name as well as status...". The degrees of the CNAA are the first wards entirely the responsibility and product of the further education system which have this equivalence.

1. *Ibid.*, p. 37.
2. *Op. cit.*, Evidence, Part I, Vol. B, p. 596.

II

THE COLLEGES OF ADVANCED TECHNOLOGY

a) *How to Cope with Numbers*

As we have seen, the decision to designate the colleges of advanced technology was not related to any great pressure of demand. It is true that there was a peak in the number of 18-year olds in 1956 and further large cohorts were expected in the early 1960s. But at the same time there were "empty" places in both universities and technical colleges as the ex-service men completed their degree and other courses. The number of technologists coming out of universities fell slightly from nearly 3,600 in 1950 to 3,360 in 1954. The numbers of external degrees in applied science gained by technical college students fell from over 500 in 1951 to over 200 in 1955. The London technical colleges were closing down courses or were continuing them with one or two students. The Cardiff college of technology produced one graduate engineer in 1956 as against 25 some years earlier.[1] Even if there had been a rapid growth in the numbers coming forward for places in technology degree courses, these could have been accommodated in existing institutions. The determination of the universities to treat the ex-service "bulge" as a temporary phenomenon and return to the smaller numbers of pre-war years, meant that such demand would have to be met by the technical colleges, and the question became, how could that best be done? The attempt in 1956 was to rationalize, rather than to expand, though in the event expansion triumphed over rationalization.

Another powerful spur to policy in 1956 was the thought that there "ought" to be a greater demand for technologists from industry. This view was strengthened by the sort of international studies which OEEC (as it was then) was publishing. The White Paper of 1956[2] quoted the results of an an OEEC questionnaire into the output of technologists from some Western European countries. Again, the lesson was equivocal. Britain, it appeared, produced in 1954 57 graduates in engineering and other applied sciences and 164 HNCs per million of the population. In the same year the USA produced 136 graduate engineers per million, though this was only half both of the actual output four years earlier and of the estimated output for 1964. Whether this comparison was worrying for Britain or not

1. Figures given in House of Commons Debate, Hansard, June 21, 1956.
2. Technical Education, HMSO, 1956.

depended on what proportion of American engineers (and some said a high one) were comparable only with British HNCs.

According to OEEC, in 1953 France, Italy, West Germany, Switzerland, Scandinavia and Benelux produced 67 graduates in technology per million of the population with individual variations from 86 in Germany, 82 in Switzerland and 70 in France to 39 in Italy. On these figures there seemed little cause for British panic, especially since Britain produced twice as many pure scientists per million as Western European countries.

It was with the USSR that the comparisons seemed awful. The USSR claimed to be producing 280 professional engineers (whose quality was admitted to be high) and 326 engineers of lower grade (certainly lower than HNC) per million of the population.

It was against this background that the Government decided to expand the technical colleges. Its object was to create a demand for advanced technology not to respond to one that already existed. A five year development programme was announced in which £70 million worth of building was to be started. The object was to increase by a half the output of advanced technologists from the colleges and double the numbers released from employment for educational courses below this level. The annual output from advanced courses (i.e. above GCE A level or ONC A level) in technical colleges was 9,500 of whom 1,500 got degrees. About half of these became technologists. The proposal in the White Paper was that the total annual output should be raised from 9,500 to 15,000 "as soon as possible" — an objective which was achieved by 1961.

The White Paper was a little vague about the way these advanced technologists should be produced. The Government was convinced that for the "highest" technological qualifications sandwich courses would become more and more appropriate and looked forward to their development through the National Council for Technological Awards. The bulk of these courses, it considered, should be carried on in colleges which concentrated on advanced courses — in other words in colleges of advanced technology. These colleges were to increase the volume of full-time advanced work, drop lower level work and develop a substantial amount of research. On the other hand 150 other colleges were providing part-time advanced courses and were expected to go on doing so.

This vagueness was rationalized by the summer of 1956. As we have seen, the Government had in the meantime decided against designating as CATs as many as possible of the colleges then receiving the 75% grant. Eight were mentioned by the Minister in the House of Commons[1] and two more were designated later.[2] In the Ministry's Circular 305, the CATs were described as those providing a full range and substantial volume of work exclusively at advanced level. Below them, regional colleges were to have a substantial volume of advanced work, area colleges were to take some students up to HNC and local colleges were to concentrate mostly on ONC-level work.

1. Three were in London: Battersea, Chelsea and Northampton College. The others were in Birmingham, Bradford, Cardiff, Loughborough and Salford.

2. Bristol in 1960 and Brunel in 1962.

The White Paper did not quantify its expectations for expansion and it is not clear that what actually happened was anticipated. Moreover, the crude overall figures, based upon the statistics of "advanced" work conceal important changes in the kinds of courses provided in the colleges and by implication in the quality of education provided. Indeed over the period of the development of the CATs there was an increasing tendency to distinguish between degree-level and "sub-degree" level advanced work. To evaluate changes in the CATs in terms of the crude 1956 categories of advanced and non-advanced would be to ignore the changing educational attitudes and ambitions stimulated by the development of the colleges themselves.

We begin, however, by considering the total numbers of students educated in the CATs at various levels and by different modes of study. In these terms the CATs were shrinking whilst most of the other colleges were expanding. In 1956, the eight designated colleges had over 32,000 students.[1] By 1964 the ten CATs had less than 23,000 students. In the same period, the numbers in further education as a whole (including evening institutes) rose from 1,900,000 to 2,750,000. The comparison of the CATs with other colleges is shown in the table below:

STUDENTS

(Thousands)

	1956	1964	% change
CATs	32.1	22.8	− 29
FE colleges other than CATs	1 123.5	1 593.5	+ 24

The decline in CATs was, of course, due to the shedding of lower level work. The proportion of advanced work certainly rose in the CATs. Figures are not available for earlier years, but generous estimates suggest that the numbers of advanced students doubled and came to represent about 50% in 1956 to nearly 95% in 1964. Figures are available from 1958, between which date and 1964 the number of advanced students in CATs increased by 30%, the major expansion being in the first two years. On the other hand, over the same period the number of advanced students in other colleges increased by 86%. Advanced work, far from being concentrated in the CATs, developed spectacularly outside them, so that the proportion of all advanced students that was in the CATs fell from 17% in 1958 to 12% in 1964. These trends were similar in all methods of study, except sandwich courses. The percentage of all full-time advanced students that were in the CATs fell from 37% in 1956 to 18%; part-time day advanced students from 15% to 6%; evening-only advanced students from 12% to 5%. It was with sandwich students that the CATs managed to increase their proportion of the total, but even here the rise was not dramatic: in 1956, 30% of advanced sandwich students were in the eight CATs in 1964, 41% were in the ten.

1. These and subsequent figures are from annual reports and *Statistics of Education*, 1956–1964 (see Tables 19 and 20).

In absolute numbers, the total of advanced sandwich students in 1956 was about 1,000 in CATs and 3,600 in all further education: in 1964 there were about 8,000 in CATs and nearly 20,000 in other colleges.

The proportion of advanced work varied according to the method of study. For full-time students in CATs the proportion of advanced work was initially high, 74% in 1956, and it increased to 95% in 1964. On the other hand, less than half the part-time day students in 1956 were doing advanced work, and when lower level work was shed, the proportion of advanced students among the part-timers, though not the absolute number, was increased. Similarly, the proportion of advanced students in evening only courses has fluctuated around 45%, though the numbers dropped rapidly. Again, sandwich students were distinctive in that they were almost entirely on advanced courses throughout the period.[1]

Within the colleges the change in the modes of study was very dramatic. The educational experience which they offered their students was quite different at the end of the period from what had been offered at the beginning. Briefly, the shift of emphasis was from part-time to full-time study. Full-time and sandwich students were 18% of the total in 1956: by 1964 they were 62%. Advanced students on full-time and sandwich courses represented 41% of the total of advanced students in 1958 (earlier figures are not available) and 70% in 1964. But this shift was as much a result of shedding lower level and part-time work as of a marked and deliberate increase in advanced full-time work.[2] In other words, what the CATs succeeded in doing, by increasing their facilities, removing their lower level work and so on, was to replace their part-time advanced students with full-time ones and to achieve a modest expansion as well. The assumption is that these part-timers were taken on by other colleges.

It is the change in mode of study which implies the distinction about level which can increasingly be made in the period up to 1966. In the Ministry of Education's statistics, advanced work means work leading to a qualification above the standard of GCE A Level or of the ONC. Some of this work is held to be of first-degree level and some below it. However, since 1945, there has been a tendency to regard the HNC and HND as less than comparable with degrees even on their narrower base. In these terms, therefore, the change in mode of study in the CATs represented an increase in the quality of education offered. The question of numbers can thus be looked at from two points of view. In terms of the numbers of individuals being educated in the CATs, these declined whilst numbers increased elsewhere. From another point of view — that of the awarding of nationally defined degree-level qualifications — the CATs rather more than held their own. The shedding of lower level part-time and sub-degree work can be said to be the cost of this change of emphasis.

To put the point perhaps overdramatically, a college with 1,000 HNC students each doing a day and an evening a week would be able to manage only 200 full-timers with the same staff and accommodation. And the HNC courses took two years, and degree-level sandwich courses four — so it is easy to see that without expansion the change from one kind of course to another would mean accommodating only one-tenth of students.

1. Table 21.
2. Tables 22 and 23.

Similarly, the White Paper did not say what it expected the size of individual institutions to be. One of the implications of concentrating on full-time work was that the overall number of students in the CATs would fall. This is indeed what happened. Colleges accommodating 8,000 students, mostly part time, in 1956 had only 2,000, mostly full time or sandwich, by 1966. Like most British universities, the CATs were very small by international standards, and now that they are universities they are expected to remain among the smallest (2,000 to 4,000) in the country.[1] They have not felt it necessary to adopt collegiate or cluster systems.

It is hard to say that they have been responsible for new architecture or building concepts. Technical colleges were built by the local authorities to the standard and cost limits laid down by the Ministry of Education. Such developments as have taken place here have been independent of the CATs.

b) *Equality of Opportunity*

The original distribution of the colleges of advanced technology was at least partly geographical. These were in London, Battersea, Chelsea and Northampton (named after a Lord, not a place). All of these did a substantial amount of work for internal degrees of the University of London, and the capital is, after all, a major centre both of population and industry. Three colleges were in other major industrial centres: Birmingham in the midlands, Bradford in west Yorkshire and Salford in south Lancashire. Loughborough was an odd case, a college which had grown under a buccaneer of a principal to be too big for the local authority and had been a direct-grant college since 1952. The only original designation to cause any surprise was the college at Cardiff which at that time had little advanced work. Two designations followed later: Brunel, just outside London, had quickly built up its Dip. Tech. courses and Bristol, which in 1956 was not even getting the 75% grant had enough advanced work by 1960 to support a college for the south-west. There was one large and important industrial area which conspicuously did not get a college: the north-east. There were three candidates, and Ministers went up there many times to try to persuade themselves that one of them would do. They did not succeed, despite all the arguments that what are euphemistically called development areas would benefit from such a college. Had the north-east been Wales it would probably have got its CAT — and had Cardiff been in the north-east its college would probably not have been designated. In the end only Bradford and Loughborough were in towns which did not already have universities. As time went on, however, the precise location of the colleges became less important. As they changed from local authority technical colleges into universities they drew their students less from their localities and more from the country as whole. To take the example of Northampton college, in 1956 only 7% of all students came from outside the south-east of England: by 1963 43% did so.[2] At Battersea comparable percentages were 35% and 73%.[3] As this occurred the colleges built more

1. Table 24.
2. Table 25.
3. Table 26.

student residences. By the end of the period 27% of their students were in college hostels or halls of residence, compared with 39% in universities.[1] Neither did the colleges of advanced technology give greater opportunities to women, who are on the whole under represented in higher education. Only when they approached university status and were extending their interest to the social sciences did they begin to accept women in any numbers.[2] Before that time, the Ministry and the colleges were complacent about the lack of opportunity for women. The CATs became increasingly restricted to people in the "typical undergraduate" age group. Consistent with the wide variety of courses in 1956 was the wide age-range of students; 15% of full-time students were under 18 and 35% over 21. Part-time students ranged from those just out of school to a great many older people on vocational courses. Over 90% of evening students in 1958/59 were 21 or over. But full-time study rapidly became the preserve of degree students. The under 18s rapidly disappeared and so did many mature students. The same group constituted the majority of the growing numbers of sandwich students. At the same time numbers of part-time students dwindled. In age, students in the CATs became increasingly like those in universities.

What can be said about the colleges, is that that they were a route to higher education for people who might otherwise not get it. In this sense they extended opportunity. Of course, it had long been the technical college tradition to accept any student who applied, regardless of formal qualifications, and offer him a course suited to his need. Up to a point, the CATs were asked to go against that tradition when they were required to drop their lower level work. This meant that an applicant who did not meet the entry requirements for a particular course could not get into the college. But the CATs quite consciously tried to keep doors open, even after they became universities, to applicants who were qualified in other than the traditional ways of grammar school and the advanced level of the General Certificate of Education. The Robbins Report showed how far the further education sector was attracting students from different home backgrounds from the universities.[3] The CATs have continued to attract more entrants from lower social class and unacademic background because they accepted people for the Diploma in Technology and later for their own degree courses with an Ordinary National Certificate qualification in place of the normal university requirement of GCE A level. This has already been dealt with in the section on the NCTA and CNAA. We need only add here that the CATs have affected practice in the university sphere. In March 1968 the University of London, the largest in the country agreed that ONC was acceptable as an entry qualification comparable to A level. It is too early to say how far this will affect the social class composition of university students as a whole. No special student grant arrangements were needed or introduced to enable the CATs to pursue their innovative entrance policies. They were placed on the same footing as universities, and every student who gets a place at a recognized institution gets a grant whose size depends on his parent's income.

1. Table 27.
2. Tables 28-31.
3. See previous section.

There were qualifications, even to this extension of opportunity as we have seen in the section on the NCTA. Extra opportunity was available only in technological subjects, and industrial financing of sandwich courses meant that the priorities of the free market might be inconsistent with the needs of social equality. The colleges of advanced technology scarcely shared in the sort of innovation which led to combined degrees and interdisciplinary programmes. At their designation they were offering a fairly limited range of courses and immediately after it even this range was reduced. By the time they became universities they had extended again largely into the social sciences. But no developments like those which were occupying the new universities took place in the CATs. They were trying to do a different job, and were engaged in different preoccupations.

c) *Content and Structure of Studies, Specialization*

In English terms, the narrowness of the CATs' range in 1956 was an argument against their becoming regarded as universities. It was not only that technology was still thought of by many university teachers as scarcely a fit subject for university study. The word "university" tended to be taken literally: a university had to offer every academic discipline. With a few exceptions, like Imperial College, London, and the London School of Economics, universities which offered a limited range did so out of poverty rather than design.

General academic opinion was so strong that the CATs themselves, like the other technical colleges, felt from the first that there was something lacking in their courses and in the educational experience they offered. Liberal studies were demanded by the NCTA and liberal studies departments were introduced into the colleges to "broaden" the student' minds. Liberal studies might mean anything from 19th century history, philosophy and current affairs to a swift overview of the world's major civilisations.

Some of the more ambitious people in liberal studies departments might claim that their departments represented in the colleges an interdisciplinary approach, might claim that they were able to contribute the insights of history, psychology, sociology to an otherwise somewhat mechanical education, and that they were enabling students to take supporting courses in disciplines other than their main ones. Some departments might be said to have approached this ideal: the liberal studies department at the Bristol college was especially active. But their success or failure must necessarily be a matter of judgment, and there are few people who would judge them a great success. Many of the colleges have accepted this, and in them the liberal studies department has largely disappeared into departments of social studies, management or industrial relations, though these departments may still "service" technological courses.

The trouble was that the technical colleges, and even the CATs lacked confidence in what they were doing. They had not then developed, as some are now doing, a coherent theory of professional education. The old concept of technical education as a series of courses where teachers expounded a body of incontrovertible facts died hard. (One must not overdo this: a number of university departments of engineering would merit the same descriptions and some technical colleges would not). There were many in the universities who described their own task as developing the full

man while the CATs and other colleges were engaged in mere technical training. It took a long time for people in the technical colleges to begin to assert that the full man might best be developed through a properly understood professional education. So the technologies were not self-confident disciplines ready to raid others for insights and experience: they allowed themselves to think that they were somehow not concerned with a liberal education, but needed that tacked on, by specially employed graduates in history and sociology.

In the liberal studies departments themselves, those graduates too seldom understood the nature of the college's main work. They thought they were there to civilize the rude mechanicals and were distressed to find themselves resented. With noble exceptions, the liberal studies experiment in the CATs, as an interdisciplinary approach, cannot be said to have been a success. But it left its mark on the colleges and perhaps made easier the acceptance of new disciplines when these became universities.

d) *Organisational Structures*

There is a very great difference in the way in which technical colleges and universities are governed in England. The universities are chartered bodies. They can do anything a private individual can do, dealing with property and incurring liabilities like an individual. (Apparently at common law a chartered university can even do something expressly prohibited by its charter!) They are, in short, independent. Each determines its own size and rate of growth and decides how to spend its money.

On the other hand 80% of the universities' revenue comes from public funds, and elaborate arrangements have been made to preserve the independence of universities. Briefly, public funds are distributed to universities through an independent University Grants Committee standing as a "buffer" between the Treasury, and later the Department of Education and Science and the universities. The Committee has a dual task, to advise the Department on the total money to be made available to the universities and to allocate this total between the universities. The grants are of two kinds, non-recurrent (capital) and recurrent. For capital grants, for the building programme, the Committee bases its advice to the government on estimates of development submitted by the universities. In periods of expansion, the Committee tells the universities what its estimates are of the growth in the total student population — but it does not give targets to individual universities. Each university's development is discussed in detail with the Committee, and when all the universities' estimates have been agreed, the UGC submits a total of figures to the Government. Subsequent discussion is confidential, and the decision on the overall size of the building programme is made and announced by the Government. The allocation of building programmes to individual universities is made by the UGC, and control of the actual building operations is in the hands of the individual universities.

Recurrent grants to the universities are in the main block grants calculated for periods of five years. Again the Government decides, after advice from the UGC, the total amount for each year of the quinquennium, the UGC allocates this between universities and each university spends it at its discretion. Exceptionally, the Committee may make an "earmarked"

grant to a university for a specific purpose. (Since January 1968, the books of the UGC and of individual universities have been open to inspection by the Comptroller and Auditor General on behalf of the Public Accounts Committee of the House of Commons.)

Within the framework just described the universities are autonomous. They have control over the balance of teaching and research, the number and standards of students admitted, the numbers of staff and individual appointments.

Individual universities normally have two tiers of government. The first, on which lay members are normally in a majority, may consist of a Court, which meets once or twice a year, and may have anything from 100 to 600 members; and a council, which administers finance, is responsible for university policy and may have between 30 and 50 members, mostly lay.

Academic policy in the university is determined by the senate or academic board, composed entirely of academic members. The senate is normally served by innumerable subcommittees. Teaching and research in faculties is normally regulated by faculty boards. Senates and boards vary greatly in the extent and importance of professorial representation and the participation and election of more junior members of staff. But the purpose of all these boards and committees is that the university should be not only self-governing but also democratic.

At the base of this institutional autonomy and academic democracy is the concept of individual academic freedom. This freedom means not only the absence of discriminatory treatment on the ground of race, sex, religion or politics. It means the right to teach according to one's own conception of fact and truth rather than according to predetermined orthodoxy. And it means the freedom to publish and pursue personal studies and researches, subject to the proper performance of accepted duties. In an institution or department this freedom cannot include the right to refuse necessary duties or an assigned place in cooperative work — but it clearly includes the right to participate in the formulation of these duties and the policy they support.

The technical colleges have a different tradition of government and are differently organised. They are, first, not autonomous institutions: they are administrated by the local education authorities. There is one sense in which, like the universities, they are independent of the state. They, too, have their "buffer" against the Government, the local authority, but they are "public" institutions and are subject to public control. Their current expenditure is met in the first place by their individual local authorities, but the authorities get a general grant from the Government, covering about 55% of their total expenditures. The grant is calculated on the current costs of the services involved and expected trends. The current costs of technical colleges are allowed for in the total sums negotiated. Advanced courses are held to service more than local needs, and expenditure on these is pooled and appportioned among all authorities.

Capital expenditure is controlled in detail by the Department of Education and Science. The Department announces the total sum available in a given year and the local authorities, with this to guide them, put in their applications for specific projects. The Department decides which of these shall be approved and what the total allocation is to each local authority. Each individual project is separately approved by the Department.

The Department also lays down standards and general requirements. Not only building projects, but even individual items of equipment and furniture must be approved by the Department if they cost £500 or more. The prior approval of the Secretary of State is required for the provision of advanced courses. The colleges do have their own governing bodies, but these are normally constituted as subcommittees of the education committee of the local authority. Normally the principal of the college attends meetings of the governing body, but he is not himself a member of it, and there is no other internal academic representation. The local authority determines the educational character of the establishment and its place in the local education system. The governors are responsible for the conduct of the establishment, its curriculum and normally the appointment of staff, subject in the latter case to the approval of the education committee.

Within the college, the system of government is normally pretty hierarchical. The principal normally decides, perhaps after consulting one or two heads of department. Within each academic department, what the head says goes. The working hours of the staff are timetabled. Naturally, there have been exceptions to this general description but normally a technical college more closely resembles a secondary school than a university.

Right at the start it was recognized that the creation of colleges of advanced technology demanded that the colleges become more independent. There were those who believed that it was impossible to create institutions of higher education which were administered by local government. In 1956 the Government did not accept this. The White Paper said that local authorities took great pride in their colleges and had often been willing to find more money than the Government had been able to allow. (Cynics said that since expenditure on advanced courses was pooled a local authority could achieve glory through their expansion at the expence of the rest). It added that to remove the colleges from local control against the wishes of the authorities could be justified neither by past experience nor by the hope of better results from more central control.

But the White Paper added the qualification that colleges of advanced technology should have "the independence appropriate to the academic level of their work". The Minister was to take steps to see that all the colleges had strong government bodies widely representative of industry and with power to spend within the broad divisions of annual estimates.

Circular 305[1] made this a condition of recognition of the colleges by the Government. The constitution of CAT governing bodies had to include strong direct representation of industry, a reasonable representation of local authorities sending substantial numbers of students to the college, and representatives of universities and the professional bodies. The condition about power to spend within broad divisions of approved estimates was repeated.

The independence which was in practice given by the local authorities to governing bodies and principals varied from place to place, as was the extent to which the principals had formal arrangements for consulting their

1. *Op. cit.*

staffs. By 1960, the colleges were getting restless of local authority administration. The strains were often created by relatively trivial matters, like the appointment of secretaries and laboratory technicians. Being governed by a subcommittee of a committee of the authority was a source of irritation, as was the sense of not being master in their own house. At the same time the local authorities were coming to regard the colleges as taking up too much of their attention and resources. The students, increasingly, came from outside the authority, the demands and standards which the colleges had to meet were increasingly national. So when the Minister in 1961 proposed to make the colleges direct grant institutions, the local authorities agreed without too much distress. There was by this time a general feeling that the colleges were ready for a further step to independence.

Becoming direct-grant colleges was more than a change in the external government of the colleges. It is true that the governing bodies were set up according to a trust deed and had full responsibility for running the college. The governors were required to submit to the Minister each year estimates of income and expenditure and to keep within the amounts approved by him. A very limited virement between the heads (5% of the smaller head) was permitted at the governors' discretion. New courses still required Ministerial approval as did the purchase of land or building and new building development. The colleges could buy equipment and furniture up to the value of £1,000 for an individual item. The Minister approved an establishment of senior staff for each college. But more important than the external change of status was its consequences for the internal government of the colleges. Half a dozen of the governors of each college were appointed by the academic boards, and the principal of the college was a governor *ex officio*. The staff were thus represented on the governing bodies of the colleges for the first time. The academic boards had other duties too. They had functions similar to those of a university senate, regulating courses and examinations and in some cases appointing junior staff. The boards normally consisted of the principal as chairman, and vice-principal, heads of departments, and a number of staff selected by their colleagues. Internal self-government and democracy began in many of the colleges at this point.

The colleges had scarcely got used to these new arrangements when the Robbins Committee[1] recommended and the Government agreed that the colleges should become full universities. The colleges were thrown into a lather of charter-making lasting anything up to two years. In some colleges as many as half a dozen draft charters were produced. The staff, individually, in groups and as a whole were engaged in determining the kind of administrative arrangements they would be working under, the kind of representative institutions which would reflect their academic democracy. If the charters, in the end, looked very like normal university charters this was because the needs of academic institutions are in the end very similar. It was not for want of thought and argument.

The novelty in this was that the staffs of technical institutions with their quite different attitudes and traditions were themselves fashioning a

1. *Higher Education*, HMSO, 1963.

university. The strains on principals and heads of departments as their roles changed was often intense. And, after all, this was an innovation in university terms too. When the new universities were founded the charter was largely determined by an academic advisory board before all but a few staff had been appointed. The creation of a new university by and out of the existing staff is something which had not been attempted in England before. The fact that it was attempted was innovatory, even though the methods by which it was achieved, by committee, pressure group, lobbying and meetings, are as old as organisations.

e) *Recruitment and Status of Teachers*

From the beginning it was recognized that the colleges of advanced technology should be properly staffed. In the White Paper of 1956 [1] the Minister said that he proposed to satisfy himself that the staff of each college were adequately qualified and had appropriate freedom to plan their own courses. In Circular 305, one of the conditions governing the recognition of CATs was that "the staff must have qualifications and experience appropriate to the level of their work." The Government decided that it must give the colleges an improved salary structure to enable them to attract such staff. And as the colleges developed over the decade it became clear that their salary scales should be made comparable with those in universities. So there were two major occasions when the salary scales in the CATs were altered in order that the right staff might be attracted.

While the CATs were technical colleges the salaries of their staffs were arranged like all the other colleges. Teachers salaries throughout the education system (but excluding the universities) are arranged by statutory committees set up for the purpose. The first committee to deal with the teacher's salaries was set up in 1919 under the chairmanship of Lord Burnham, and the committees which negotiate teacher's salaries are still known as Burnham Committees. They consist of two panels or sides, one representing the teachers organisations, the others representing organisations of local education authorities together (since 1965) with a number of representatives of the Department of Education. The Burnham main committee deals with the salaries of teachers in primary and secondary schools. And it is only after the negotiation in the main committee has been completed that the Burnham Further Education Committee begins to discuss the salaries of teachers in technical and other further education colleges. Indeed the further education scales are related to the scales of school teachers in that the basic scales for both are the same. (About 20% of teachers in further education are on the basic scale).

Before the negotiations in 1956 there were four main grades of teachers in colleges of further education. There were assistants (later assistant lecturers) Grade A and Grade B. Both of these scales were very long. [2] The lecturer and senior lecturer grades were comparatively short, spread over 4 and 6 years respectively. The fourth main grade was of heads of depart-

1. *Technical Education*, HMSO, 1956.
2. Table 33.

ments. There were 5 groups of these whose salary scale was related to the size of their departments.

The 1956 Burnham award retained this salary structure for both the colleges of further education and the colleges of advanced technology and gave increases all round in all grades. There were, however, three changes which related to the CATs alone. In the first place the lower Grade A assistantships were abolished for these colleges. In the second place a new grade of "reader" was introduced at a salary scale slightly above that of the senior lecturer scale. A readership was to be offered to a member of staff who was largely concerned with research, and this grade was introduced into the colleges in order to give them the opportunity of embarking upon serious research. The final main change was to add another group to the five heads of department group. Group 6 simply put another £200 on the top of the head of department salary scale.

The really fundamental innovation here was the new reader grade, and it took the colleges some time to find the people they were looking for. In some cases a number of readers were appointed who disappeared within a year or two. But as we shall see the introduction of this grade almost certainly enabled the colleges to extend their commitment to research. A later change was the introduction of a grade of principal lecturer. A department with more than four senior lecturers could appoint one principal lecturer.

The next major change came in 1964. At this time the Government referred the salaries of staffs in universities and the colleges of advanced technology to the National Incomes Commission. (The NIC was one of a continuing number of Government attempts to control what were regarded as economically damaging rises of income.) The National Incomes Commission was considering university and CAT salaries after the Government had announced that the CATs were to have university status, and even before this reference the Government had announced an adjustment in the salaries of senior staff at the CATs to make them comparable with a recent rise in university salaries. The Ministry of Education told the NIC that "there need now be no delay at all in establishing the principle that both the staff grades and the salary scales or ranges in the colleges should be identical with whatever grades and salary scales or ranges are laid down for the universities." The NIC endorsed this principle and agreed that its recommendations for university salaries would need to be relevant to colleges of advanced technology. The NIC recognized that the colleges drew their staffs from sources other than those which were normal for the universities — especially industry. It thought, however, that the salary structure and scales it proposed were flexible enough to meet the needs of the CATs.

One attempt was made at the time of the NIC hearings to alter the basis on which university salaries were determined. The Association of Teachers in Technical Institutions said that in the structure of the higher grades in universities and colleges there should be an essential connection between grade and function. The association thought that above the level of lecturer there should be two parallel but distinct grades of senior lecturer, concerned more with teaching, and reader, concerned more with research. It also thought that there should be two grades of head of department, and that heads of large departments should have recognized

deputies. These proposals did represent a quite different view of the staff of academic institutions from that which is common in universities. Briefly, it might be said that in a university a man or woman is appointed for himself. This is particularly true at the higher levels. What a university does is to hire a person. This was made explicit in the NIC report of the National Incomes Commission which said that one could not use the principle of comparability of *jobs* for determining the level of university salaries: what one could do was look at the level of salary which *people* doing university work would get if they were in other jobs. The Association of Teachers in Technical Institutions sought to regard appointments less as the appointment of people than as the filling of posts. Their salary structure was designed to give effect to this principle, and to end what they regarded as the wasteful consequences of the over-flexible university scales. The National Incomes Commission, however, did not agree with the Association of Teacher in Technical Institutions, and an opportunity to innovate, good or bad as the case may be, went by.

The changeover from the old Burnham scales to the new university scales was extremely complicated. There were not many places on the two scales which were strictly comparable, and colleges found themselves determining an individual's grade with little but generalized guidance from the National Incomes Commission. The main career grade in the universities was that of lecturer rather than assistant lecturer. The assistant lectureship in universities being a kind of cadet grade with a 3-year scale. (In some technical colleges the assistant lectureship was also a cadet grade with staff staying on the long scale for a mere two or three years.) Above the grade of lecturer the staffs of universities were paid not on scales at all but on a range of salaries. Readers and senior lecturers had a range of salaries with varying maxima up to £3,250. Professors had a minimum of £3,400 and a maximum of £4,750, but any individual professor might have a salary anywhere between these limits. What happened was that some assistant lecturers in the colleges went on to the university lecturer scale, though many remained on personal scales which resembled their old assistant lecturer scales. Lecturers and senior lecturers in the colleges went on to the university lecturer scale. Principal lecturers, readers, and heads of departments went on to the university reader and senior lecturer range of salaries, and most heads of departments became professors.

One general consequence of these changes was that the salaries of individual members of the staffs of colleges of advanced technology rose generally by about 20%.

The change in the composition of the staffs of the colleges over the 10 years from 1956 to 1966 was very striking. In the first place, there was a remarkable growth in the number of full-time teachers. In 1956, there were in the first eight colleges designated as CATs fewer than 850 full-time teachers. By 1966, there were over 2,500 in the ten colleges.[1] Though substantial, the growth was gradual: designation did not mean an immediate flood of new recruits to the colleges. Recruitment increased to a maximum from 1962 to 1964 when over 300 new teachers were recruited each year. Afterwards they continued to expand though at a slower rate.[2]

1. Table 34.
2. Table 35.

The CATs were of course not the only institutions to expand their staffs at this time. Indeed their growth was but a small part of the expansion of higher and further education in the 1950s and 1960s. The FE sector also trebled its teachers over this period and the universities doubled theirs. But there was an important difference between these two on the one hand, and the CATs on the other. In the universities and the FE colleges both student numbers and the output of qualified people increased at a corresponding rate. In the CATs, total student numbers declined and the extra output of Dip. Tech. graduates over what graduates the colleges would have produced anyway was small. Indeed, it is possible to argue that there was a serious decline in the output of the CATs if holders of HNC and HND are taken into account. In 1956 about 800 HNC and 50 HND graduates were produced in the colleges. By 1966 there were only about 350 HNC graduates, whilst HND had been abandoned shortly after designation.

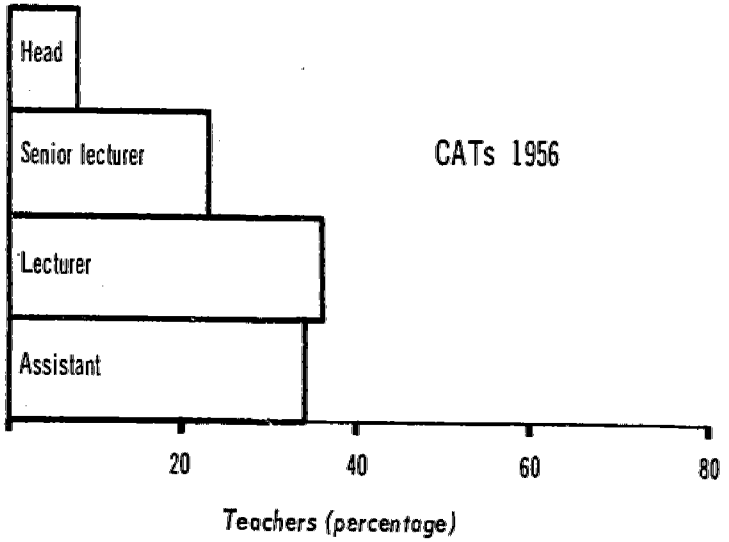
An important object of designating the CATs was to enable then to attract highly qualified staff. This did not mean that academic qualifications were to be the sole criterion; we have already seen the efforts of the NCTA to equate industrial experience with these. But they became increasingly important. Less than 70% of the staff in 1956 were graduates: by 1966 over 90% were. A greater proportion of staff had higher degrees too: in 1956, only 29%; by 1966, 44%.[1] The class of degree held by the teachers also improved. The Robbins Committee made a comparison of the qualifications held by teachers in universities, the CATs and other FE colleges in 1961/62.[2] They saw the CATs well on the way to parity with the universities. At least 93%[3] of the university teachers, 91% of CAT teachers and only 39% of teachers in FE were graduates. About 50% of the university teachers in science and technology had first-class honours degrees, compared with 33% of teachers in the CATs and only 20% of maths and science graduates teaching in other FE colleges. Most of the changes in the CATs arose from their practice of recruiting almost entirely graduates. But they also got rid of a great number of their non-graduate teachers. In the first two years after designation, about half the staff that left were not graduates and the percentage of leavers with first and higher degrees was lower than those of recruits throughout the period.[4]

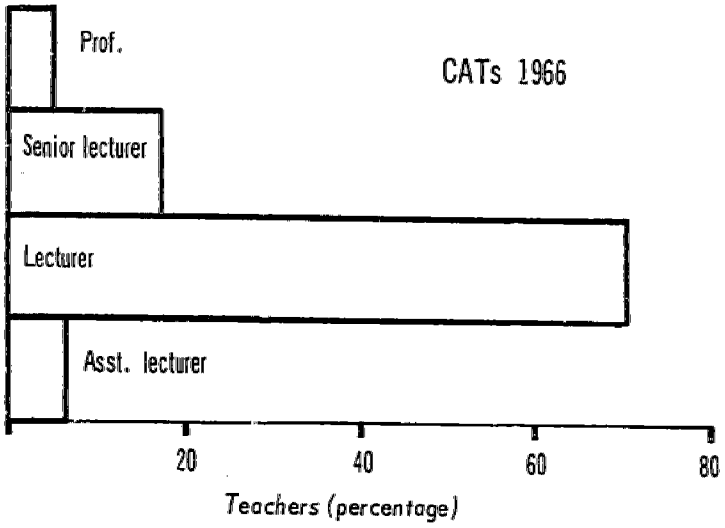
The recruits to the colleges were also rather young, mostly in their twenties and thirties. Leavers, on the other hand, tended to be rather older. Consequently the average (mean) age of teachers in the CATs dropped by more than a year from about 40 to 39. In both 1956 and 1966, there were a great many young teachers: about 13% of the total were under 30 and nearly half under 35. These figures do not differ radically from those of university teachers or teachers in other FE colleges.[5] Perhaps the most important feature of the ages of teachers in the CATs was the loss of their older teachers. The proportion over 45 dropped from 29 to 22%. Older teachers had presented something of a problem for

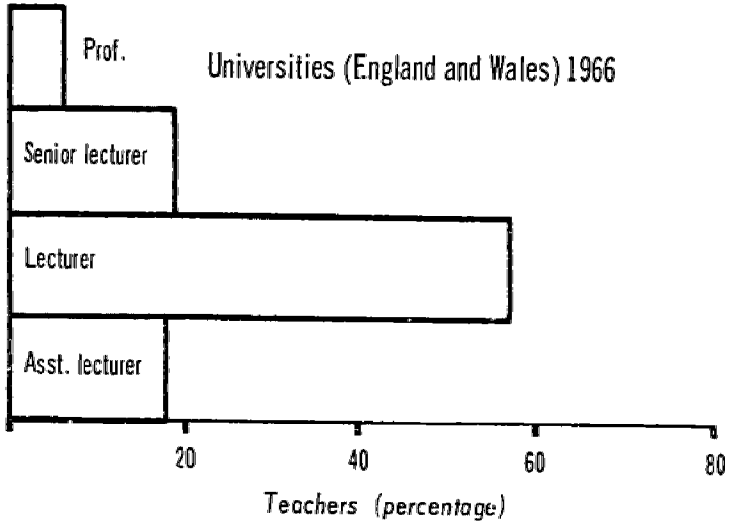
1. Table 36.
2. *Op. cit.*, Appendix Three, Part I, Section 5, Part III, Section 1.
3. 7% of non-graduate includes 3% non response.
4. Table 37.
5. Table 38.

Figure 2

GRADES OF TEACHERS IN THE CATs, 1956 AND 1966, AND UNIVERSITIES, 1966







the colleges. A great many were still assistants, having been at the top of the assistantship scale for a number of years, yet unable to progress beyond because they were generally rather poorly qualified. Often those in higher grades had been promoted on the principle of seniority. People in the CATs felt that they were unsuitable for the new level of work. Often they were able to shed them to other colleges with lower level and part-time work, but in colleges where there was already none, the problem was serious. In one case, when university status was granted, the principal of the college simply interviewed every member of his staff and explained to those who were not suitable for university work that they would have a brighter future somewhere else.

Changes in the length of service of teachers tend to follow changes in age. The colleges had recruited a great many staff in a short time, so that by 1966 few of their teachers had been with them since 1956. Moreover, as technical colleges they had been used to a fairly rapid turnover of staff. Even in 1956 nearly half the staff (48%) had been there less than five years, and a further 30% less than ten. By 1966 the first figure had increased 3% and the second remained the same.[1] The average length of service had dropped by nearly a year from 7.6 to 6.7 years. This was mainly the result of the loss of long serving teachers. The proportion with more than 25 years' service had dropped from 5 to 1%.

If we look at the grades of teachers in the CATs we get some idea of the structural changes they underwent. In 1956, the distribution of staff among the three main teaching grades was remarkably even.[2] The importance of the assistantship at this time is clearly seen; 34% of teachers were assistants, 36% lecturers and 23% senior lecturers. The relationship between grades and salaries was naturally a close one. The salary profile for that year confirms the evenness of the grade profile.[3] The grade profile and the salary profile of 1966 contrast sharply. Now 71% of all staff were called lecturers, though they were on the university scale and the functions were different from the Burnham lecturer: but the title itself is important. The proportion of assistant lecturers and senior lecturers were relatively small.

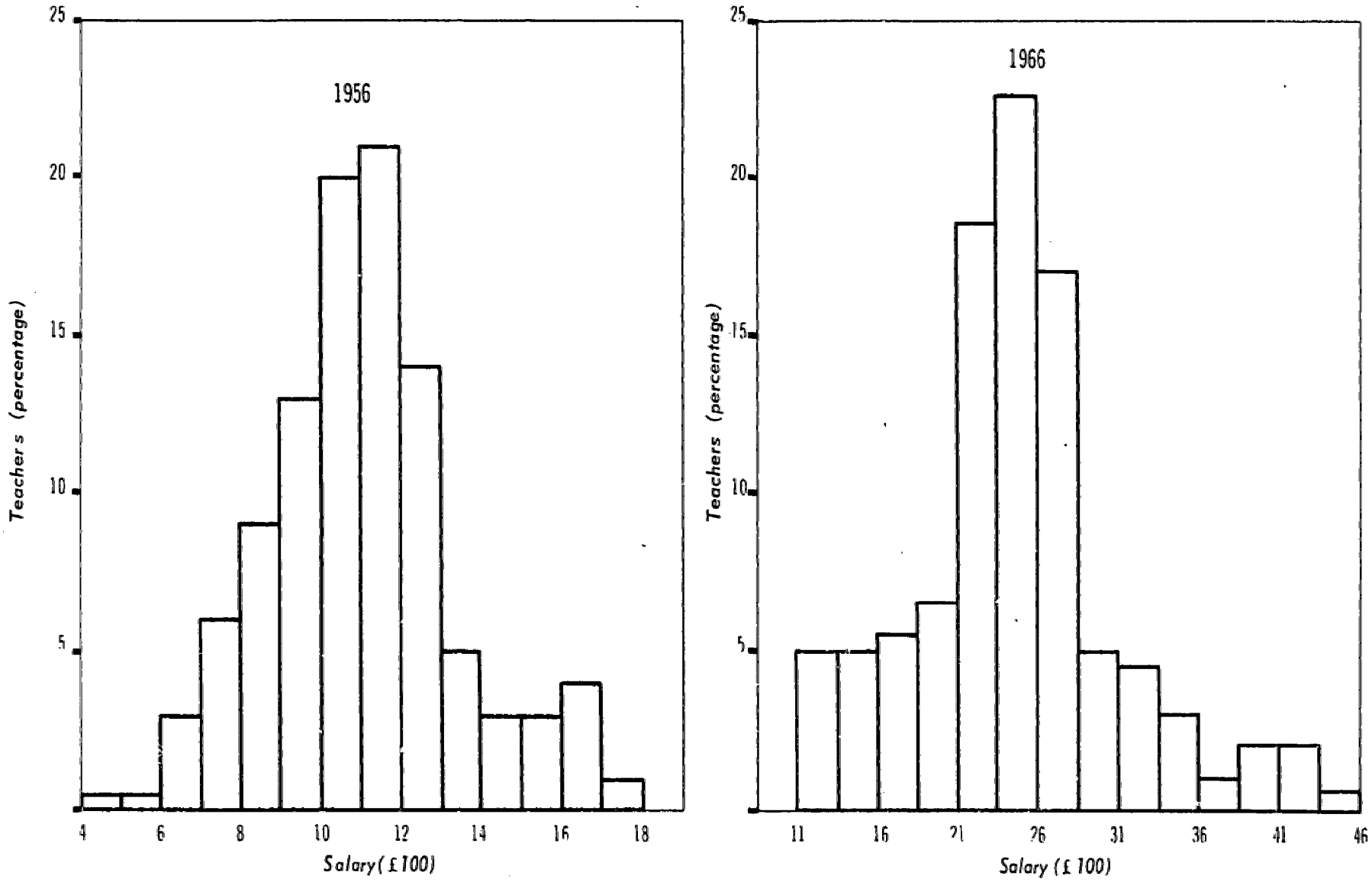
These overall figures result from the interaction of developments in patterns of recruitment, leaving and promotion.

Increasingly, new staff came not as assistants but as lecturers. Even when the colleges were on the Burnham scale about 50% of recruits came into this grade. The figure increased to about 60% after the assimilation to university scales. At the same time the assistantship became increasingly a probationary grade for recent graduates and only about 30% of recruits came into this grade. After assimilation the grade was solely probationary. The proportion of staff recruited into higher grades was small. Most senior lecturers and principal lecturers were promoted from within the same college. But quite a few heads of departments came from outside the colleges, and shortly after the assimilation, the colleges recruited a number of professors.[4]

1. Table 39.
2. Fig. 2.
3. Fig. 3.
4. Table 40.

Figure 3

DISTRIBUTION OF SALARIES OF TEACHERS IN THE CATs, 1956 AND 1966



Not even all the recruitment that the CATs undertook was sufficient to satisfy their requirements for expansion. Vacancies at all levels remained unfilled for long periods though the problem was more serious at the top. Robbins found that the CATs had a very high proportion of unfilled vacancies compared with the other colleges in the FE system. In 1962, 15% of all posts in the CATs were vacant, compared with an estimated 7 to 10% in FE colleges. This actually represented something of an improvement for the CATs. In 1960 there had been about 16% vacancies and in 1961 about 18%. In the senior grades in 1962, the problem was quite acute. Exactly half of the readerships, 20% of senior lectureships and 18% of principal lectureships were vacant.

Apart from transfers of complete lower level departments from the CATs, the rate of leaving was about 10% of staff each year. In the first few years after designation the largest single group of leavers were assistants: they represented 51% in 1957 but after that 20-30%. A higher proportion of lecturers left later in the period, reaching 45% by 1963, and 50% after assimilation. Many of the leavers in earlier years were senior lecturers: the figure reached 30% in 1961. But then there was a decline and after assimilation only about 10% of leavers were (university) senior lecturers.[1]

Promotion policy contributed directly to the grade structures in the colleges and also indirectly to recruiting and leaving patterns. The balance between promotion and recruitment was an important one for individuals and it varied between grades. At the lower end of the scale assistantships were almost invariably filled by recruiting from outside. But most lecturers also came from outside. There were, however, so many lectureships available as the colleges expanded that it is hard to imagine the promotion prospects for assistants being anything but good. In higher grades promotion was more common. About half the senior lectureships and over 85% of principal lectureships were filled by promotion. But readers were again exceptional. The colleges had to look about for suitably qualified people and less than half of the readerships were filled by promotion.[2]

We cannot look at recruits and leavers without looking at their sources and destinations. The most important feature of the sources of staff in the CATs was that, throughout the period of this study, less than half had come from a previous educational post. The most important change was that among those who had come from education, the proportion coming from universities increased steadily. In 1956 it was common practice, indeed common policy for the colleges to recruit teachers from industry; over 30% in the eight colleges had come from there. Other technical colleges were the main source of teachers from within the education system (22% of the total); schools had supplied 11% and the universities only 8%. The colleges' predilection for experience meant that very few, only 9%, were taking up their first appointment.[3]

By 1966 teachers from outside education still accounted for nearly 60% of the total, industry itself representing 35%. There had been an

1. Table 41.
2. Table 42.
3. Table 43.

increase in the percentage receiving first appointments to 13% and in teachers from universities to 15%.

Despite the trend toward recruitment of university teachers, the CATs were recruiting from a very much wider range than the universities. The Robbins Report[1] found that only 5% of teachers appointed to new posts in the universities in 1960 had come from outside them. Leaving out promotions we see that only about 14% of recruits had come from outside. The extremely limited experience of most university teachers was shown by the facts that only 13% of all teachers in 1961 had been employed outside the universities since their first appointment in one, and a quarter of the total had spent their entire careers in the university from which they had graduated: another 11% were teaching in the same one but had taught elsewhere in the meantime.

Relating recruitment figures to grades, we see that the various sources contributed differently at different levels. Naturally many assistants were receiving their first appointment, though nearly a third of the total had come from industry. And the CATs turned even more to industry for their lecturers. About 40% of the total, both before and after assimilation to the NIC scales, came from there. In higher grades the universities were more important: 32% of readers, 53% of heads of department (before 1964) and (later) 54% of professors had come from them. Again, there are one or two exceptions. Principal lecturers, for instance, did not follow the general pattern because most were promoted. And industry could supply the sort of people with practical research experience to take on the difficult job of reader.[2]

Changes in the destinations of leavers followed a pattern similar, though not completely so, to that of source of recruits. Increasingly, people left to go to the universities: in 1957 7% did; by 1966 31% did. There was a corresponding decline in the percentages going to other technical colleges, from 44% in 1957 to 7% in 1965 and 21% in 1966.[3] Industry as a destination of staff was less important than as a source. Indeed, it seems that not only people coming from educational posts were reluctant to go back once they were out. Only 12% of all leavers went into industry whilst 30% of recruits came from it. 60% of people who had come from industry went into another educational post and only 22% went back. Only 11% of people that had come from within education left the CATs for industry.[4]

The very spectacular development of staffs in the CATs was barely foreseen by most people in 1956. Although both the White Paper and Circular 305 implied an improved staff/student ratio and a capacity for research in the teaching staff, they expected most of this to be achieved by the time of designation. Neither allowed for the subsequent expansion of staff accompanied by a fall in total student numbers. In consequence, many of the means to undertake such radical changes were not suited to

1. *Op. cit.* Appendix Three, Part I, Section 8.
2. Table 44.
3. Table 45.
4. Table 46.

the task. In the case of staff, the main problem was the salary structure. For most of the period the colleges were subject to the Burnham scales. This, like all scales, implied an educational philosophy. It was designed for colleges with a wide range of levels and type of work: most FE colleges were like this. Most, too, were pretty closely identified with the schools; the basic salary scale was the same, and the main teaching grade the assistantship. But grades on the Burnham scale were arranged according to level of work. Grade A assistants undertook only school-level work, grade Bs, school and intermediate level. Lecturer was the first grade for university level work. Thus the CATs were concentrating almost solely upon university work with a career structure more suited for school level. Their legacy in 1956 included many assistants with few or no qualifications stuck at the top of their scale, and who had previously taught only lower level work. At the same time, however, the assistantship scale could serve as a sort of probationary grade. Bright young men would rush through it past the stationary members of an older generati . The arrangement of grades also meant that most teachers appointed to the colleges after 1956 had to be lecturers (or above). But this was at the same time a defiance of the Burnham structure as the main career grade was intended to be the assistantship. But the scale, as it were, had its own back. The lecturer grade was very short (as was senior lectureship), and this militated against its use as a career grade. The rate of leaving was high considering the rapid expansion at the time. Promotion helped to alleviate the problem and the creation of the principal lectureship enabled the colleges to relieve the pressure on the grades immediately below.

There were other reasons why the colleges should recruit lecturers rather than other grades of teachers. They had to establish themselves as centres of technology with departments that could be seen to compare with, if not exceed those in the universities. This required not only a great number of staff but also experienced people. Thus although they turned to the universities to some extent for recent graduates and for high-level staff, industry was the main source of people with the appropriate qualifications and experience. As technical colleges and unlike the universities, the CATs were well used to appointing young people from outside to responsible posts: the numbers were now greater.

The assimilation to the NIC scale in 1964 in many ways confirmed the previous practices of the colleges. The main grade was now the lectureship, reflecting the pattern of teaching and recruitment. It represented the old lecturer and senior lecturer grades combined, with an "efficiency bar" roughly at the old promotion point. The bar was passed fairly easily however: inefficiency rather than efficiency had to be proved so the scale offered a clear promotion prospect and there were no restrictions at that point on the size of establishment that there had been with promotion to the old senior lectureship. The new senior lectureship was now a more exclusive grade, parallel with the old principal lectureship. And at the bottom end of the scale the assistant lecturer grade was specifically designed as a cadetship.

It is hard to say yet how much difference the new scales have made in the colleges. But the staff are certainly better off financially as well as in terms of career prospects. We have already noted that assimilation gave 20% rises all round. Over the period of this study, salaries in the CATs

rose astronomically. In 1956, the mean salary was £1,060: by 1966 it had increased by 127% to £2,450. This was nearly twice as fast as any other major income group in the country and three times the rise in the retail price index. University teachers' mean salaries over the same period increased by about 50% from about £1,500 to £2,300. There is some evidence that at the very bottom of the scale university teachers' salaries are inferior to those of teachers in other colleges.[1] But at the time of writing a report[2] by the Prices and Incomes Board (son of NIC) had attempted to amend this, and has also merged the assistant lecturer and lecturer scales into one so establishing even more clearly the career prospects in the university teachers' scale.

The development of staff in the CATs was not without its cost. Firstly, the total salary bill increased enormously. In 1956 for full-time staff in the ten colleges it was less than £1 million. Assimilation alone added 20% to the current figure and by 1966 the total was over £6 million. Secondly, we have already seen that the output of the colleges increased little if at all; and thirdly, there was the cost to other sectors of education and industry. As the proportion of graduate teachers in the CATs increased steadily, in the rest of the FE sector it declined. Now the CATs were not solely responsible for this: the universities too were expanding. But a significant number of FE teachers left for the CATs, as our figures show, and in addition the CATs attracted teachers who might otherwise have gone to other FE colleges. And it is strange to think that a measure specifically to increase the supply of qualified people going into industry should attract from industry, in the space of the first ten years, something like a thousand well qualified young, yet experienced people.

f) *Teaching and Research*

The technical colleges have always done a certain amount of post-graduate work and research, in accordance with their tradition of offering courses at every level and in the service of local industry. But post-graduate work has not, even now, had the same place in the colleges as in the universities. The numbers are much smaller, and much of the study is done part time and in the evenings. The main growth of research has been relatively recent too.

In 1956 there were perhaps 400 students in the CATs doing work above first-degree level, whether by course or research, and most of these were in Battersea and Chelsea. By the time the Robbins Committee reported, there were 420 full-time (including sandwich), 120 part time and 310 evening only. This represented something like 4% of all advanced students, compared with 14% in universities. Even by 1965, when the CATs became universities themselves, only three of them, Birmigham (Aston) Chelsea and Northampton (City) awarded a similar proportion of higher degrees to first degrees as universities. Two of them awarded no higher degrees at all. We have already seen how few MCTs (the one innovation

1. E.E. Robinson, "Pay and the Academics", *Higher Education Review*, October 1968.

2. National Board for Prices and Incomes, *Standing Reference on the Pay of University Teachers in Great Britain*, First Report, London, HMSO, 1968.

in this field) were awarded. In 1965 the report on longer-term post-graduate courses was published.[1] This dealt with courses of longer than a month's duration, but it showed that there were in that year 264 courses of which 218 were a year or more long and 46 less than a year. Of the total the CATs offered 47, but a quarter of these were shorter courses, compared with 12% in the universities and two thirds in the regional colleges. The CATs effort on the shorter courses was declining, however, like that of the universities. There were 92 students on shorter CAT courses in 1964–65 compared with 105 the year before. The inquiry did not show the connections between the colleges and industry in a very favourable light. Only 11% of the total number of students on post-graduate courses in the CATs were financed by their employers, compared with 20% in the universities and 40% in the regional colleges. On the other hand slightly more of the CAT students (60%) than university students (54%) had been in some kind of work since taking their first degree or other qualification. The percentage of those with a degree attending courses at universities was 79% and at CATs 72%. If Dip. Tech.s are included with degrees the proportions were 83 and 80%.

So it is only by the end of the period we are considering that the CATs began to face the problems of balance between undergraduate and post-graduate work which had become common in universities. The growth of post-graduate work was not in response to detailed planning. It was a natural consequence of their development. The more work they did at degree level, the more candidates appeared for post-degree work. The more like universities the colleges became, the more university attitudes they adopted. Insofar as the CATs have become like other universities they have similar problems.

The progress of research has been similar, aided by specific policy measures. We have already seen how the grade of reader was created in the CAT salary scales specifically to encourage the development of research.

There is very little information about the amount of time actually spent on research in CATs: the Robbins Committee did not inquire about this as it did for universities. Perhaps the average teaching hours a week noted in the Robbins Report offers evidence by implication. In 1955-56 heads of departments in technical colleges taught for 12.3 hours a week. By 1961–62 the heads of department in CATs were teaching 5.5 hours, compared with 9.6 hours in other technical colleges. In this case the difference is likely to be explained more by administration than research. But readers in CATs were teaching only nine hours a week on average in 1961–62 and principal lecturers 11.8 hours, compared with 13.1 hours in the other colleges. Senior lecturers and lecturers in the other colleges were teaching about the same amount of time in the two years, but those in the CATs were doing three and four hours less. Assistant lecturers in the CATs were doing seven hours less, compared with an hour or two less in the other colleges. Some of this time must have become available for research. By comparison university teachers were teaching between 6.3 hours (professors) to 8.2 hours (assistant lecturers). Certainly more research seemed to get done.

1. Report on an enquiry into longer term post-graduate courses for engineers and technology 1964–65, by H. Arthur, Group training Officer of the Atomic Energy Authority, HMSO, 1965.

It is impossible to discover any overall figures, but there are plenty of indications. For example, between 1956 and 1966 at the Chelsea and Battersea colleges, both already well known for their research efforts, the number of research publications grew from 35 to 118 and 46 to 208 respectively.

The CATs attracted research funds from Government Departments, the Research Councils, foundations and private industry. The distribution of these funds between Government sources and others was not significantly different in the CATs from the universities even by 1965–66, but research funds made up a much lower proportion of the CATs' total income (between 2 and 3%) than that of the universities as a whole (over 11%), but among the other sources in the CATs the foundations were almost negligible, indicating their greater proportionate service to industry.

Special arrangements were made for releasing teaching staff for research work. As early as 1946,[1] it was accepted that technical college teachers could spend two-fifths of their time on research without affecting their pay and superannuation, and this applied to teachers who were acting as consultants to industry. This practice was commended and confirmed by the Willis Jackson Report[2] in 1957, and in the subsequent Circular 336.[3] The Circular recommended that "Research, particularly applied research and research into teaching methods, and opportunities for consultant work in industry should be encouraged by providing facilities and, where appropriate, by relieving a teacher of part of his teaching load and by allowing him to retain honoraria and fees.

In teaching there was very much less difference in between the CATs and universities than many people imagined.[4] The stereotype of the technical colleges was of instruction through lectures and large classes and little else; the stereotype of the universities was of a largely tutorial system. But the Robbins Report showed how unrealistic these stereotypes were. In the first place, staff student ratios were very similar. Allowing for the difficulties created by part-time teachers and part-time students in CATs and technical colleges, the report showed that the overall staff-student ratios were 7.5 to 1 in universities, 7.8 in CATs and 7.1 in the other colleges. If part-time teachers were included, the CAT ratio was 6.8 and that of the other colleges 5.7. In the universities virtually all teachers were graduates, (unlike the CATs and other colleges).

But these overall university figures are somewhat misleading, because faculties vary, there is the complication of post-graduate students, and the universities of Oxford and Cambridge with their less favourable ratios were excluded. If one takes faculties of technology only, as a reasonable comparison with the CATs, the overall ratio was 8.8 and the undergraduate ratio 7.3 (compared with the CAT 7.5).

The amount of informal contact students had with members of staff was also very similar. In universities as a whole 39% of undergraduate students had "spoken with academic staff in the week before being inter-

1. Circular 94, HMSO, 1946.
2. *The Supply and Training of Teachers for Technical Colleges*, HMSO, 1957.
3. Circular 336, HMSO, 1958.
4. The figures in this section are from *Higher Education*, Appendix Two (B).

viewed other than in periods of formal instruction and excluding casual remarks and brief greetings". In university technology faculties the proportion was 44%, in CATs 43% and in other formal technical colleges 43%.

The different kinds of teaching methods were not remarkably dissimilar either. Full-time students in CATs had on average 21 hours of teaching a week, compared with nearly 15 hours in universities but with 20 hours in technology faculties, and over 23 hours in other technical colleges. It is likely that in 1961–62 (when the Robbins figures were gathered) the CATs were becoming more like universities and less like the other technical colleges in this respect, though there were only three hours a week in it.

The distribution between different kinds of teaching was similar too. Students in CATs, on average, spent 11 hours in lectures, one and a half hours in seminars, almost no time in tutorials, seven hours in practicals and field work and one and a half hours in classes doing written exercises. Undergraduates in university technology faculties spent very similar periods, a little more tutorials and little fewer seminars, that is all. Slightly fewer CAT students (60%) than university technology students (68%) said they would have liked changes in their teaching arrangements. Both groups, and especially the CAT students would have liked more seminars and tutorials.

There were greater differences in the amount of written work required. Over 70% of CAT students were required to produce written work once a week, and only 6% were not required to produce any at all. In the universities the percentages were 58 and 14, in technology faculties 56 and 15, and in other technical colleges 55 and 18. The staff in the CATs took the written work seriously: 95% of them made written comments upon it, compared with 44% in university technology faculties.

But CAT students had less official supervision than university students both in academic and personal matters. On the academic side, 80% of them had an official supervisor or other advice on the course compared with 89% in universities as a whole, 87% in technology faculties and 85% in other colleges. The CAT students met their supervisors less frequently too: 62% of those with supervisors met them only twice a term or less, compared with 42% in universities, nearly a half in technological faculties and 43% in other technical colleges. Similarly, 80% of CAT students were not allocated to a personal adviser, compared with 60% in universities and 86% in other technical colleges.

The average time spent by CAT students on private study was nearly 21 hours (or nearly as much as they spent being taught), compared with 23 hours in universities, 20.5 hours in technology faculties and 19 hours in other colleges. Their total working week was 42 hours compared with 38 hours in universities, 40 hours in technology faculties and nearly 42.5 in other colleges. The average size of lecture audiences in CATs was 16, compared with 31 in university faculties of technology. Just under half the courses in science and technology in the CATs were given to fewer than ten students, compared with just over a quarter in technology faculties.

It is fairly safe to say that since Robbins, the CATs moved even nearer to the universities in teaching methods. Certainly, in a number of them, tutorials and small seminars have become more common. But this has seldom been accompanied by a reduction in the number of lectures,

and staff in the former CATs are beginning to think that the timetables of their students are getting overburdened.

It is very hard to argue that the CATs were innovators in this respect — with the exception of the use of industrial experience and training, which has already been covered in the section on the Diploma in Technology. As their staffs came to include more members who had been in universities and as the CAT aspired to become universities, their teaching methods changed slightly. In the newly established social science faculties, university practice is all but universal.

g) *Role and Status of Students*

Students had no formal part at all to play in the decision to found the colleges of advanced technology, though as we have seen it was to some extent the assumed demand from students and potential students which led to it and to the founding of the National Council for Technological Awards. In the past, and still today to some extent, the technical colleges treated their students in an entirely authoritarian way. The college acted as if it were an extension of school. Its students' timetables were laid down for the terms, registers of attendance were marked for classes which were normally lectures followed by respectful questions. It was assumed that the courses were matters for the staff, and perhaps a sponsoring industry, but not the students. Still less did anyone think that students should have some say in running the institution. In this latter the colleges did not differ from universities. A university might offer more choice than a college, among and within disciplines, but it would not (and most still do not) imagine that students should have anything to say about the running of the institution or the content and structure of courses.

In both colleges and universities student interests are looked after by student unions, which normally run all student activities and act as pressure groups on the administration.

When the ten colleges became CATs, they carried with them the traditions of their technical college past. But their growing independence led to growing internal participation, first among staff and then among students. The best example of this was in charter-making, where in many of the colleges the students' union was consulted and produced memoranda and drafts. In these cases the students had more influence on the government of their college than in any university.

When the colleges of advanced technology were designated only one of them had any number of students in residence. This was Loughborough which in 1965–66 had 93% of its students in halls of residence, more than any other English university.

In its appendix on conditions governing the recognition of CATs, Circular 305 said briefly, "Provision for residential accommodation is important... the initial aim should be to allow each student to be in residence for at least one year of a full-time course or one academic session of a sandwich course." The rationale behind this was threefold: First, the colleges were to become "national" institutions, taking their students from all parts of the country, rather than serving their localities only. Suitable lodgings for students were often hard to find, so the colleges,

like universities, thought of building halls. Second, there were held to be educational reasons for housing students together on or near the college campus. An inquiry at Birmingham University in 1951–52[1] suggested that students living in halls or hostels read books outside their own subject, visited the university Institute of Fine Arts, had friends in other faculties, attended meetings of university societies and played in university sports clubs more than students living at home or in lodgings. Other evidence was more equivocal, but there was a prevailing feeling that hall was educative. Third, Oxford and Cambridge had colleges, other universities had halls or hostels — so halls conferred status on an aspiring academic institution.

By the time the Robbins Committee reported the CATs had very many more students in residence (about 12%, excluding Loughborough) than other technical colleges (3%). Universities had 31% in college, hall or hostel. CATs, other technical colleges and universities had similar proportions in lodgings (47, 49 and 54% respectively). Another big difference was in the proportion of students living at home; the CATs had 41%, other technical colleges 48% and universities 15%. These figures show how far the CATs were still, five years after most of them had been designated, meeting a local demand. By 1965–66, only 29% of students in former CATs lived at home, against 11% in other universities; 40% lived in lodgings (50% in universities) and 27% in halls (39% in universities).[2]

As for student finance, a change was made in the middle of the development of the CATs, but this was for the whole of higher education not for the CATs alone. By the Education Act, 1962, the local authorities were given the duty to make grants to students with prescribed qualification admitted to designated courses: before that Act the local authorities had only the power to make grants, not a duty to do so. The prescribed qualifications,[3] included two passes at GCE A level and a 60% pass in ONC and OND examinations. The designated courses were mainly those leading to a degree or diploma in technology.[4] There were also discretionary awards which the local authorities could make to those who did not fulfil the requirements for mandatory grants but were considered suitable.

The whole grant structure after 1962 was based upon the recommendations of the Anderson Report.[5] Grants cover, tuition fees and give a standard sum for maintenance. In 1962 the tuition fees in most universities were £60 a year for arts subjects and £75 for science subjects. Needless to say these fees were not meant to cover the cost of tuition. From the autumn of 1963 fees for full-time courses in the CATs were raised to £ 60 a year.

The standard figure for maintenance varied according to the assumed expense of living in different universities: briefly, the grants for Oxford, Cambridge and London have been £25 to £35 higher than elsewhere.

1. Reported in *Higher Education*, Appendix Two (A), Part V.
2. UGC Returns, *op. cit.*
3. University and other Awards Regulations, HMSO, 1962.
4. *Ibid.*
5. *Grants to Students*, HMSO, 1960.

The standard figure is intended to cover the cost of board and lodging during term-time; annual expenditure on clothes, books, instruments and materials; term-time pocket money and expenditure on personal laundry and travel; and a contribution towards maintenance in the vacations. There are also additional allowances for longer terms, vacation courses, dependents and so on.

The maximum grant, consisting of fees and maintenance may be reduced by a parental contribution. This is assessed on an income scale, with allowances for children at school and so on. In 1962 no contribution was payable by parents with an assessed income of less than £700 (today it is £900). Over that figure the contribution was at the rate of 8 to 10% of assessed income. But however wealthy the family, the student got a minimum grant of £50. The grants were normally paid through the student's university or college, and the standard figures for maintenance are revised every three years or so.

The CATs, like the universities, gained from the 1962 Act both in consistency in award-making and in the relaxation of the amount of the parental contribution. To the CATs the improvement must have seemed even more important, since they were increasingly attracting students with mandatory awards. The previous section has traced the support given to Dip. Tech. students by industry. The falling off of industrial support can be traced directly to the extension to the CATs of mandatory grant arrangements after 1962.

There is one other aspect of student life in the CATs which distinguished these colleges. Student amenities in the colleges were on the whole poor, and students with industrial connections often looked to their firms for recreational facilities: they would play sport for the works team, for example, rather than the college team. The firm would attract their loyalty rather than the college. This was particularly true where the firms were big. It was often hard for the colleges to encourage that spirit of a community which is part of the ambition of English educational institutions, including universities.

These students were different, too, in that they were not, very often, straight from school. They acquired status from their industrial connections. They demanded to be treated as adults. The phenomenon (which many universities welcomed) of more mature students lingered longer in the CATs even after the ex-servicemen had gone.

For this reason the student atmosphere in the colleges was very different from that in universities. Student life was less tense. Even so one of them has already in 1967 experienced the kind of student demonstration that has hitherto been associated more with universities than colleges of advanced technology.

h) *Higher Education and the Outside world*

There can be no doubt that the establishment of the CATs and their development into universities embodied a new concept of the function of higher education within society. We have seen how the creation of the Diploma in Technology opened a route to honours degree-level qualifications for those who would otherwise not attain them. We have seen how

the universities were largely unprepared in the early 1950s to accept technology as an academic discipline and how, even when they did, they were interested in theory rather than practice. They were not, on the whole, ready for any intimate collaboration with industry. The achievement of the CATs was to attain university status through an award given for success in "sandwich" courses, where industry was involved in the education of students. The outside world was thus deeply involved in academic matters.

At the same time the CATs reintroduced professional education as a fit purpose of universities. Since the middle ages, faculties of theology, law and medicine had prepared students for professions. But this had been sanctified by the centuries, and universities were not keen to extend the principle in the middle of the 20th century. The teaching profession, for example, still remains a peripheral concern of the universities, and "education" is still hardly respectable as an academic subject. The CATs made the professional education of engineers and other technologists a university discipline. And gradually university engineering departments themselves are changing to accommodate this achievement.

The third achievement of the CATs was to show that a substantial number of new institutions of higher education could be created out of old ones. The usual way of founding a university was to set up an academic planning board, appoint a good vice-chancellor who would in turn appoint good staff. From these men and women would grow an academic institution. The CATs were not established in this way. They existed already, in another lowlier form: their growth and development occurred because their existing staffs were normally ready and able to accept new burdens and unfamiliar responsibilities.

This development contained a paradox: while the CATs were taking the outside world back into the university sphere, they were also cutting themselves off from their local communities. They not only attracted students from a much wider area, they also moved out of the control of local government. A number of the colleges say that their relations with their local authorities are better now than they were when they were administered by them (certainly a large development at Aston, for example, in the very centre of Birmingham could not have taken place without local authority help and support) but the relationship cannot be so close, and the local authorities' pride in its former CATs is now vicarious.

At the same time, the CATs ceased to serve their localities in another way. They dropped all their lower level and most of their part-time work. This was the exact opposite of a "new approach to adult and continuing education."[1] It was a retreat from them. This catalogue of gains and losses is even now creating the tensions which will attend the establishment of the polytechnics.

i) *Evaluation, Planning and Finance*

There has seldom been any systematic evaluation of innovations in English education. This is partly because educational administration is decentralized. The job of the Minister is to see that the local authorities do *their* job, not to do it himself. Similarly the CATs themselves were not

1. See Common Outline, p. 13.

used to systematic evaluation. The principal of a technical college would produce an annual report for his governing body, with or without statistics as the case may be. He seldom paused to ask where the institution was going partly because the major responsibilities lay with the local authority. When change came to the CATs it came quickly, and in the general hurly burly evaluation was neglected. Only after a number of years did most principals begin to call for statistics and surveys in their own colleges, to illuminate problems and policies. As to planning, the CATs were in no condition to do much. Until the Robbins Committee reported they had no security of future, status or function. They were responding to plans rather than planning.

It was the Ministry of Education that was doing the planning. The initiative was theirs throughout. And they had a number of instruments to ensure compatibility between national objectives and institutional ones. First was the NCTA, which was the major academic influence on the colleges. Second, the Ministry influenced the Burnham negotiations enough to give the CATs salary scales from other technical colleges, even though the Ministry was then not formally represented on the Burnham Committee and the teachers' association was against it. Third, the Ministry controlled the building programme (see below). Fourth, the influence of the Inspectorate was important. Her Majesty's inspectors value their independence: they do have a special status inside the Ministry. But they are the Ministry's main link with the colleges. They are a channel of information both ways, explaining policy to the colleges and keeping the Ministry in touch with institutions. From 1962 an inspector sat as an assessor on the governing bodies of CATs.

There were a number of interesting developments in the financing of the CATs, and they can be said to have influenced the move toward lower unit costs of building in universities. A considerable building effort went into the ten colleges after they were designated, and later when they became universities.

The CATs experienced three different methods of financing in the course of their development. When they were local authority colleges, they were financed by and through the authorities. The latter in England have the power to raise rates (local taxes on property) but these have for some time been insufficient for their needs. Their expenditures have therefore been subsidized by central Government out of its revenues, from taxes and elsewhere. In 1956 the Government grants were calculated as a percentage of local authority expenditures, the Government meeting about 60%. From 1959 they were made in block grants, negotiated in advance. The point of the latter was supposedly to give local authorities greater freedom in deciding how to spend the money allocated to them. For the CATs, these arrangements meant that they had to compete for their local authorities' attention and finance, not only with other local technical colleges and with other sectors of education but with all other calls on local authority finance.

There was one important mitigation of this: the 75% grant introduced after 1951, for advanced work. This meant that the local authority had to find only 25% of the current costs of advanced courses, rather than the full 40%. With the 1959 changes, grant arrangements were even

more favourable to expenditure on the CATs: advanced technological education was met by a "pool" to which all local authorities contributed. This gave local authorities with CATs and other colleges doing advanced work the chance to expand at almost no cost to themselves. There is no doubt that this contributed to their eagerness to expand. The decision about a course's eligibility for the 75% grant and for "pool" finance was made by the Ministry, in effect by the Inspectorate.

In 1962 the CATs became direct grant institutions and got their money directly from the Ministry of Education. From 1965 they were universities receiving their Government grants through the University Grants Committee. Under this arrangement the UGC acts as a buffer between the universities and the government. The universities argue with the UGC about their individual needs and the UGC argues with the Government about the total amount of grant. The grant is then made to the UGC for distribution among the universities. In this way, and with some exceptions, the Government does not give money directly to any university.

One can distinguish, too, between current and capital expenditure. Under the local authorities, capital spending was financed through loans (the interest on which was subsidized through Government grants like other current expenditure.) But the Minister of Education had to sanction not only the total programme of buildings to be started in any one year but also each individual project. The Government had two controls: through the expenditure which it recognized as attracting its block grants and through approvals of individual building works.

When the CATs became direct grant institutions these two controls were, as it were, amalgamated. Their capital expenditure was financed by the direct grants from the Government, a system which resembled that of the UGC. Capital spending in universities is paid for through grants: they have no loan charges to meet.

It is hard to argue in principle that any of these arrangements was better for the CATs than the others. The colleges themselves began to find local authority finance irksome, but this was almost certainly for other than financial reasons, like their growing desire for autonomy. They look back with nostalgia and affection to their direct grant days. Leaving the local authorities was a liberation, and they valued the direct contact with the Ministry and the sense of being specially favoured. Their move to the UGC arrangements coincided with economic crisis and less generous Government expenditure, so their feeling of becoming just one of many universities was heightened by the realization that they were competing for more stringent finance.

III

POLYTECHNICS

a) *Numbers*

The establishment of polytechnics, announced in the Government's White Paper of 1966,[1] was certainly bound up with meeting the demand for places in higher education. In the six years from 1961–62 to 1967–68 the number of students in full-time higher education in Great Britain[2] grew from 193,000 to 376,000,[3] and this increase in absolute numbers was greater than in the previous century. The unprecedented expansion was a consequence of the Government's response to the demand for places after the publication of the Robbins Report[4] which had acted both as a guide to the Government and as a stimulant to both demand and the will to accommodate it. But the basis of the increased demand for places was the coincidence of what have become known as the "bulge" (the increase in the number of young people of relevant age due to the post-war surge in births) and the "trend" (the growing proportion of the age group getting school leaving qualifications).

When the Robbins Committee was appointed the provision of university places had for some years grown more slowly than the relevant group of school leavers, so the latter's opportunities proportionally declined. There was no clear policy on how to respond to the growing number of applicants. It was the achievement of the Robbins Committee to supply a philosophy for expansion. It said that ratio of entrants to the output of those with two or more passes at GCE A level should remain constant. The Committee then translated this principle into numbers on the basis of pretty conservative assumptions. As the Committee itself thought likely, the proportion of the age group getting two or more A levels rose from 6.9 in 1961 to 9.6 in 1966 not to 8.4% as Robbins assumed.

So the number of leavers with relevant qualifications was 26% higher than assumed, only six years from the base year. And the difference was

1. *A Plan for Polytechnics and other Colleges*, HMSO, 1966.
2. England, Wales and Scotland.
3. These and subsequent figures are taken from a unit study: *The Impact of Robbins*, J.R. King, R. Layard, C.A. Moser, Penguin, 1969.
4. *Higher Education*, HMSO, 1963.

due not so much to greater numbers in schools as to greater numbers getting two or more A levels. What is interesting is that the difference between the assumed and actual rate of growth was much greater for girls than for boys. The Government accepted the Robbins Committee's quantitative recommendations with a speed at least partly induced by the forthcoming general election. For the universities this meant a 40% increase over four years to 197,000 places. The universities actually offered to accommodate 10% more than required but in the event they met the target almost exactly. Unfortunately this was not enough to meet the Robbins' principle — even though it did meet the Robbins' numbers. This was because the number of qualified school leavers had risen — so the ratio of entrants to leavers fell by about 15%. Neither do the plans for the next five years put things right: the new official target for 1971–72 (220,000 to 225,000 places) is about 20,000 above Robbins but the ratio of entrants to school leavers on the latest projections will still be 10% lower than Robbins'.

In contrast to this the two other main sectors of higher education, the colleges of education (for teacher training) and the colleges of further education, have expanded remarkably. In the colleges of education the Robbins' recommendations have been exceeded by 25% by 1967–68.

Our main concern here is with further education. We have seen that this sectors has in some respects always been regarded as a "safety valve" — taking those who were able to do a course of higher education but for some reason had not got into a university. This might be because of a shortage of places or because the applicants had unacceptable qualifications. The Robbins Committee thought that as more people went to university and colleges of education, the entry rate to further education would fall. In the event it rose. In 1968 it was well above the Robbins' recommendations.

The reasons for these differences from Robbins are highly complex. One was the simple administrative point that in expansion a Government has to work on numbers, not principles. The assumptions about A level were seriously falsified in 5 years, but by then the planning based on the numbers has been done. It is easy to forget now, too, that by previous standards Robbins was recommending a stunning expansion: over 80% by 1973–74 for all higher education. It would be unrealistic to expect Governments to do more, even though the Committee emphasized the conservatism of its assumptions.

But there was the further factor that a change of Government in 1964 has encouraged a change of attitude. The 1966 White Paper[1] spoke of "developing a distinctive sector of higher education within the further education system to complement the universities and colleges of education". Once this had been decided the attempt to keep the expansion of universities in line with the Robbins' principles became, to put it midly, much less urgent.

There were, according to the White Paper, 40,000 full-time and sandwich students on advanced courses at further education colleges in England and Wales. Of these, nearly 12,000 were working for degrees and 8,000 for HNDs. Over 100,000 students were taking advanced courses part-time,

1. *Op. cit.*

2,500 of them for degrees and 50,000 for HNCs. All but one of the regional colleges were offering full-time degree courses, as were 30 of the area colleges and colleges of commerce. Some 40 colleges of art were engaged in advanced work. The volume of advanced work varied from college to college: 25 of them had more than 500 full-time students; seven had more than 1,000. Eight had more than 500 full-time degree students, nine had fewer than 50. And these figures did not include large numbers of students taking courses which were higher than A level in standard but lower than degree level.

Quoting the National Plan,[1] the White Paper said that by 1969–70 there should be 70,000 full-time (including sandwich) advanced students in further education, compared with Robbins' 51,000 by 1973–74. Over 60,000 of these places were to be in England and Wales.[2]

And with this the Government was brought up against all the familiar arguments which attended the establishment of the CATs: this time it had few doubts. The Government would try to concentrate advanced work in 30 polytechnics. The reasons why the Government chose to accommodate the students in a distinctive sector of higher education have become familiar during the courses of this study. It sought to preserve the technical college tradition, to give professional and technical education a high status, to give opportunities to part-time students, to have a sector of higher education under public administration, particularly of the local authorities, to avoid the permanent depression of the technical colleges which would follow from a single hierarchical system. The educational distinction of the colleges, that they should be "comprehensive academic communities" accommodating students "at all levels of higher education", will be discussed later. For the moment it is enough to say that the Government took advantage of the opportunity offered by the growing demand for higher education to introduce a new concept and new institutions.

There were to be 28 polytechnics selected,[3] of which six were single existing colleges of technology. The rest were to be made up of neighbouring colleges of technology, art, commerce and so on. The geographical spread was fair, at least so far as centres of population were concerned. (The north-east, which had failed to get a CAT, got three polytechnics). But there were places where the new polytechnics seemed to be replacing the "lost" CATs. Manchester (Salford), Birmingham, Bristol, Treforest (Cardiff) and other places where the polytechnics were alongside new universities — Coventry (Warwick) and Brighton (Sussex). Some areas were still without polytechnics, Humberside and East Anglia, for example. Altogether, including London, just over half the polytechnics were in university towns.

These polytechnics are to be the main centres for the development of full-time higher education within the further education system, and it is not intended to add to their list for at least ten years. The object is to reduce substantially the number of colleges engaged in full-time higher education, and colleges not already engaged in higher education are not expected to embark on it. On the other hand colleges not designated as

1. *The National Plan*, HMSO, 1965.
2. See below, section g.
3. Later 30.

polytechnics would continue to offer full-time courses in higher education where they satisfied the criteria for their approval.

The size of individual polytechnics would necessarily vary, since they were made up in different ways. But the polytechnics were expected to have long-term plans for growth to at least 2,000 full-time students, plus part-time students from the areas they serve. It is of course too early to say how far the expectations of concentration and growth have been fulfilled.

What has been said about equality of opportunity in the NCTA and the CATs has relevance too to the polytechnics. The technical colleges have traditionally attempted to accommodate the sons and daughters of manual workers and others who were rejected by the selective route to universities. Perhaps the major effort in the polytechnics was to offer substantial opportunity to part-time students. As the then Secretary of State for Education and Science said[1] "There are tens of thousands of part-time students who need advanced courses either to supplement other qualifications or because for one reason or another they missed the full-time route. There are immense fields of talent and aspiration here; common justice and social need combine to demand that they should be harvested".

Hitherto part-time students had been thought of as a sort of residual. The Robbins Committee was not even required to consider them by its terms of reference. The history of the CATs had shown how the growing status of an institution was achieved at the expense of part-timers who were transferred elsewhere. If this were to continue, part-timers would never become established in first rate institutions.

The establishment of the polytechnics was perhaps the first official recognition of the needs of part-time students at the highest levels. It showed a determination to create institutions which would at the same time be of high standing and performance and treat part-time studies as a permanent and important part of their work in their own right.

b) *Content and Structure of Studies, Specialization*

The major educational contribution of the polytechnics is likely to be the extension of sandwich courses and the purposes of professional education from the technologies to the social sciences. This is being achieved through the expanded CNAA.[2] Even in 1965 the Woolwich polytechnic in London had pioneered sandwich courses in business studies at honours-degree level. The Enfield College of Technology (to be part of a polytechnic in north London) has sandwich courses in mathematics for business and in social science. For the former the students spend an integrated part of their time in industry; in the latter they go into social work, child care, national and local government offices, industry and planning departments for their "industrial experience", according to their speciality. The notion of mathematicians and economists spending part of their course in firms is still somewhat shocking — but welcome: even the drop-outs from the mathematics course are commanding high initial salaries.

1. In a speech at Woolwich Polytechnic, April 27, 1965.
2. See the NCTA study, *supra*.

A second educational contribution of the colleges is in offering courses below degree level. As Mr. Crosland said, "It is here that the colleges meet the needs of the thousands of young people who will occupy the all important intermediate posts in industry, business and the professions — the high-level technicians and middle managers who must support the scientists, technologists and top managers in a modern community. These students both for their own sake and for obvious social and economic reasons, must have a full share of the resources of the colleges, and not be neglected through preoccupation with the (degree level) category of student".[1]

This, at any rate is the theory, but the Government have scarcely backed it in practice. If it was policy to accommodate this lower level work in the polytechnics one would expect the Government to encourage it in every possible way; in salaries for example. At the end of 1967, salaries of staff in further education were referred to an arbitral body after the breakdown of the Burnham negotiations. The question arose whether the salaries in polytechnics should be comparable with those in universities. The representatives of the DES and the local authorities argued that "Higher education was not synonymous with work at university level, and a high proportion of the work in polytechnics... would be below degree standard. In some of the polytechnics, moreoever, a certain proportion of work which was below the level of higher education would be continuing at least for some years to come. The proportion of post-graduate to undergraduate work was never likely to approach that which was commonly found in universities: nor was the amount of effort devoted to research. The comparison was not a comparison of like with like, and it was therefore reasonable that there should be differences in salaries".[2]

The lesson was very clear. If the staff of polytechnics were to improve their salaries they must become like the universities and drop lower level work. The Government was telling them that the polytechnics' road to better salaries was to reverse Government policy. This kind of action over matters of salary is a far more effective influence on what actually happens in the colleges than any amount of policy statements and White Papers, and in this respect the Department can be said to be virtually promoting the collapse of its own policy.

A third contribution was to accommodate growing numbers of arts and social science students. This arose from the swing away from science in the sixth forms of schools, and it was reflected in the numbers of entrants to higher education. The Dainton Report[3] showed that between 1962 and 1966 entrants to arts and social science faculties of universities increased by 58% and to technology faculties by 35%. In the colleges of further education there was a similarly greater increase in courses other than in science and technology. The numbers entering advanced full-time (including sandwich) courses in subjects other than science and technology rose from

1. Woolwich speech, 1965.

2. Report of the Arbitral Body of Salary Scales for Teachers in Establishments of Further Education, 1965.

3. *Enquiry into the Flow of Candidates in Science and Technology into Higher Education*, HMSO, 1968.

3,700 in 1961 to 7,900 in 1965, compared with an increase from 4,000 to 7,000 in science and technology. The non-science entrants had surpassed science entrants, and the proportion of the total taking science and technology fell from 52% to 47%.[1]

So far from becoming specialized institutions, the polytechnics were extending their range. Liberal and business studies were joined by sociology and economics. In a number of colleges of technology the arts and social science staff were suggesting that the "of technology" should be dropped from the title. This caused a good deal of irritation and defensiveness among their technological colleagues.

c) *Organisational Structures*

The 1966 White Paper said it would be a condition of designation for a polytechnic that the arrangements for government and academic organisation were consistent with those recommended by the Secretary of State. Subsequently legislation was introduced to provide for the making by local education authorities of instruments and articles of government for the governing bodies of maintained colleges of education and of technical and other colleges of further education.[2] In *Notes for Guidance* on the government and academic organisation of polytechnics the Secretary of State said[3] "that the polytechnics should have suitably constituted governing bodies with a large measure of autonomy".

He added that the polytechnics must of course operate within national policies and within limits set by the financial and legal responsibilities of the local education authority. The Secretary of State would determine the number of polytechnics and co-ordinate development throughout the system through his control of building programmes and the approval of courses; he would continue to set and enforce minimum standards. The salary and grading structures for the academic staff would also be settled under national arrangements. The local authorities, within national policies, would settle the broad range of courses to be provided. They would retain their controls in financial and administrative matters such as the approval of estimates, capital development and level of fees.

However, within limits set by national policy and dependence on public finance, the polytechnics were to be given all possible freedom in managing themselves with the minimum detailed control by the maintaining authorities.

The *Notes for Guidance* suggested that a polytechnic's governing body should be a balanced and broadly based one, composed of: representatives of the maintaining local education authority; members from neighbouring local authorities supplying part-time students; a strong representation from industry, commerce and the professions; the director[4] of the polytechnic

1. *Ibid.*, Table 10.

2. The Education Act (No. 2), 1968.

3. Sent to local authorities with a copy of the Secretary of State's Parliamentary Statement, April 5, 1967.

4. A name coined for the head of a polytechnic, to distinguish him from the principals of constituent colleges.

ex officio and other members of the academic staff, including some members elected by the staff; other members with relevant experience including perhaps university representatives, teachers from schools and other further education colleges and other suitable individuals. The local chief education officer, though not a member should be empowered to attend or be represented and speak at all meetings of the governing body.

The articles of government should contain a clear statement of the responsibilities to be reserved to the local education authority and those to be assigned to the governing body, the director and academic board. Within the national and local limits referred to above the governing body should be responsible for the general direction of the polytechnic. It should submit the estimates of the polytechnic to the authority, and within the estimates as approved should be free to incur expenditure without further reference to the authority. In order to promote freedom of action the main subheads should be drawn widely and there should be provision for virement within them. Under the general direction of the governing body the director should be responsible for the college's internal organisation, management and discipline.

The articles of government should make provision for an academic board whose membership should include the director, heads of departments, other senior officers, other members of the teaching staff chosen by the staff and co-opted members from outside, perhaps from institutions with which the polytechnic had links. Within the general policy of the college and subject to the ultimate responsibility of the governing body the responsibilities of the academic board should cover planning, co-ordination, development and oversight of all academic work including the admission and examination of students.

The articles of government should also provide for the appointment and dismissal of staff. The *Notes for Guidance* said that the director, the deputy director and chief administrative officer should be appointed by the governing body subject to confirmation by the education authority. The director should be responsible for the appointment or promotion of members of staff, but the governing body should be represented on the selection committee for the more important appointments. The articles of government should specify the arrangements for the suspension and dismissal of staff.

The *Notes for Guidance* also discussed the position of students, and said that provision should be made for the students' union to conduct and manage its own affairs and funds. Arrangements should enable representations on matters of proper concern to students to be made on their behalf to the governing body, the director or the academic board as appropriate. The power of suspending a student for misconduct should rest with the director, and the power of expulsion with the governing body. There should be a recognized procedure, with a right of appeal for such cases.

These arrangements proposed for the governing bodies for polytechnics were quite new in the public system of higher education. If one looks back at the development of the colleges of advanced technology, one sees that the local authorities retained control over the day-to-day working of the college right up to the point at which the colleges became direct-grant institutions. The governing bodies of the CATs were strengthened, they

were not given effective power. The *Notes for Guidance* were an attempt to import into colleges administered by the local authorities the degree of academic independence, self-government and democracy that had hitherto been confined to universities.

This was not universally acceptable. A number of local authorities produced schemes of government which did not begin to satisfy the requirements. The length of time between the publication of the *Notes for Guidance* and approval of the first schemes for polytechnics, from April 1967 to May 1968, was attributable, partly at least, to the need to persuade some local authorities to agree.

There is no doubt that the new arrangements will give greater independence and responsibility to the academic staff of the polytechnics. This has involved a new kind of relationship between the colleges and the organs of state. This is neither the autonomy of the universities, protected by the "buffer" of the University Grants Committee. Neither is it the former dependence of the colleges upon the local authorities for even trivial decisions. It is an attempt to import university independence into the public system of higher education. Naturally this will have important implications for the relationships between the staff themselves. The same kind of tensions as were experienced by the CATs are now being experienced in the polytechnics. New relationships between principals and heads of departments and between senior staff and junior staff in the planning and organisation of academic matters will now develop with all the strains that this will impose on the staff as a whole. It is not that the administrative structures now evolved are very new. The novelty is that these structures are being evolved in local authority colleges.

d) *Teachers, Teaching and Research*

When the colleges of advanced technology were designated they were given a salary structure which was noticeably different from that in other colleges of further education. This was done against the wishes of the staff of the majority of colleges. With the announcement about the polytechnics, the wishes of the staff associations prevailed. No special salary structure was created for the polytechnics. This contributed to the difficulties which we have already described.

The arbitral body[1] reported that the Council for National Academic Awards had often stated that the Burnham further education awards did not provide salaries sufficient to obtain the calibre of staff required for the development of the kind of course the Council hoped to recognize, and the CNAA had at least once formally argued this to the Burnham Further Education Committee. There were known to be cases where the council had had to withdraw recognition from a course because of the inability of the college to appoint staff of the required calibre.

Perhaps the most important anomaly occurred in the Arbitral Body's award to the heads of departments in polytechnics. There are several grades of head of department in technical colleges,[2] but under the award

1. *Op. cit.*
2. *Op. cit.*

only the highest grade, Grade VI was to carry a salary greater than the minimum of the university professor scale, and it fell several hundred pounds short of the university professor's average salary. This meant that any head of department who was able to move from a polytechnic to a professorship at a university could reasonably expect a salary increase of up to £1,000. The criterion for making a department a Grade VI one was the number of full-time degree-level students in it. It could only become Grade VI mandatorily if it had at least 300 such students. This is very much bigger than most university departments. It was hard to see how the colleges could be expected to provide an alternative but no less worthy experience of higher education unless at least a few heads of departments could expect salaries at least comparable to professors in universities.

In other words so far from there being improved salary conditions and career prospects, the polytechnics have started under a handicap compared with universities.

Research was not mentioned in the White Paper of 1966. The Secretary of State did attach four paragraphs on the subject to the *Notes for Guidance* in April 1967. In these it was held that the main responsibility of the polytechnics would be as teaching institutions, but that provision should be made for research which was essential to the proper fulfilment of the teaching function and the maintenance and development of close links with local industry. The Secretary of State hoped the polytechnics would be ready to undertake *ad hoc* research projects on behalf of industry or under contracts from the research councils and other bodies. This was to be done without prejudice to the colleges' other work and without adding to the permanent establishment unless the cost was covered by the arrangements with the sponsors.

He also hoped that suitably qualified members of the teaching staff would pursue research where it would contribute to better teaching, and he saw that some personal experience of research was necessary for teachers who were responsible for supervising the projects which formed part of some courses. But he did not envisage that it would normally be necessary for teachers to devote the whole or most of their time to research, nor would he expect full-time research assistants to be employed on any considerable scale.

On the other hand teachers should be able to keep abreast with new knowledge through having an appropriate time for private study. Where appropriate they should also be able to work for the higher degrees of universities and the CNAA and where possible of associating their research with that of an accessible university research establishment or industrial organisation.

It is clear that as yet the volume of research in polytechnics is not such as to cause the problems which are normally expected to be dealt with under this section.

It is also too early to say whether the polytechnics are likely to make any major innovations in teaching. In so far as they have adopted the sandwich-course principle they are following in lines laid down by the CATs and some of their own number. In so far as they are offering fewer formal lectures and more seminars and tutorials they are accepting the fact

that higher education in universities and elsewhere has normally demanded it. We saw in the CAT study how surprisingly little difference there was in the educational experience of students in the technology faculties of universities, in colleges of advanced technology and in the other technical colleges some of which are now polytechnics.

e) *Role and Status of Students*

We have seen in the study of the CATs that in technical education students often have a different status from those in universities. A good proportion of them are older, partly because part-time courses take longer, partly because students embark on their courses later in life. Most of them have had some experience in industry and gain in status from that experience. They cannot be treated as if their course were a continuation of school and as if they themselves were inexperienced teenagers.

On the other hand, there is only one example here of the polytechnics leading to institutional innovations. Students are becoming members of both academic boards and governing bodies.[1] The very fact that these boards were being created often for the first time, but in any case were largely reconstituted, made this move more possible. But there is some evidence that pressure came from the new and young staff who had been recruited to the polytechnics from universities. In all institutions of higher education in Britain, the younger staff have found themselves caught between the students with whom they often sympathize (and among whom they themselves were so recently) and the demands of the institution and its senior members. In the fluid situation which marked the announcement of polytechnic policy, these young staff were able to help the students to real advances. And ministers made it clear that they were not opposed to students on governing bodies — which gave a good deal of impetus to the movement in those polytechnics which were resisting it. It is always hard to follow the movements of an underground stream but the students in polytechnics were in contact with their contemporaries in universities through the National Union of Students, and it is not fanciful to suggest that part of the pressure of the demand in universities for "student power" grew from the spreading knowledge of developments in polytechnics. One need not make too much of this: international events were not doubt fundamentally important, but one should not overlook it either.

At all events, the polytechnics have been (at the time of writing) relatively immune from student take-overs. There is rumbling beneath the surface, but it has not yet broken out.

There is one major exception to this: the Hornsey College of Art, which is due to be merged into the polytechnic in north London. Here the students occupied the building for many weeks in May and June, and demanded changes not only in the college itself but also in the whole structure of art education. Here, interestingly, the principal had encouraged the students' militancy against the merger, only to find it turned against himself.

1. See Article "Student Power in FE" by John Pratt, *Higher Education Review*, Summer 1969.

It is already clear that the place of students in the new polytechnics as in the universities will be quite different in the future from what it has been in the past, but in exactly what way it will differ is not at all clear.

One major grievance of the polytechnic students is on physical accommodation. The polytechnics have been built, of course, upon existing institutions, and ones which have been very lavishly equipped in some respects and very ill-equipped in others. Their scientific and technical laboratories and workshops have been almost over-equipped. Their libraries have been scanty and places for private study almost nil. This was in some ways a hangover from the old technical college belief that knowledge should be imparted by the teacher in a lecture, the students should write it down and reproduce it in examinations. The idea that the students themselves might read and think about material for themselves is a comparatively new growth.

At the same time, the growth of student unions has been very slow in the technical colleges, and even now there has been little physical provision for them. They have to exist in the exiguous accommodation the colleges can spare from already overcrowded buildings. By comparison, the universities normally have very lavish union accommodation provided by the UGC, which the polytechnics are scarcely provided with. The fact that they are being started at a time of national economy means that they can expect little soon. Indeed, ministers have even tried to rationalize this student poverty by saying that polytechnic students are somehow different. Not surprisingly the Government has not said what it is prepared to do for polytechnic student unions, and this is a cause of great resentment among their students.

f) *Higher Education and the Outside World*

We have seen that one purpose of the development of polytechnics was to bring the concept of public service and service to industry into higher education.

In his speech at Woolwich[1] the Secretary of State for Education and Science said: "In Britain as elsewhere, there is an ever-increasing need and demand for vocational, professional and industrially-based courses in higher education — at full-time degree level, at full-time just below degree level, at part-time advanced level, and so on. This demand cannot be fully met by the universities. It *must* be fully met if we are to progress as a nation in the modern technological world. In our view it therefore requires a separate sector, with a separate tradition and outlook within the higher education system".

He added: "It is desirable in itself that a substantial part of the higher education system should be under social control, and directly responsive to social needs. It is further desirable that local government, responsible for the schools and having started and built up so many institutions of higher education, should maintain a reasonable stake in higher education".

1. *Op. cit.*

He quoted with approval a report by the Association of Teachers in Technical Institutions which said: "The underlying assumption is that the student's primary motivation is the profession he intends to follow. He is committed to a profession from the outset and his course of study is closely integrated with his professional work. He is given direct experience of professional practice at an early stage in his course... He and the staff who teach him maintain close contact with the profession and, as a rule, many of his teachers have themselves spent time practising the professional occupation for which they are preparing him... The technical college tradition is to maintain close contact with the world of employment and to provide higher education in which education and professional experience are obtained concurrently in a single integrated course".

And he then added: "The leading colleges must surely build on their own proud tradition of service to industry, business and the professions, and not set out simply to duplicate the provision in the universities. As the ATTI Report points out, if they seek merely to extend the number of external degree courses they offer, they will come to be regarded as places for students who fail to get into university. Of course they should not try to be different just for the sake of being different. But they should exploit their own traditions and standards of excellence, and develop the fields in which they can make their own distinctive contribution to meeting society's needs".

It would be right to claim that the polytechnics represent a new approach to adult and continuing education. Of course, technical colleges had always offered refresher courses and had taken people into long-term courses without conventional formal qualifications. But at any rate in intention the polytechnic policy was to do more than this.

What has been called "adult", as distinct from "further" education has been provided in Britain by voluntary bodies like the Workers' Educational Association, and the university extra-mural departments. It is fair to say that this has been thought of as education for leisure. It has been concerned with people's interests and hobbies — and has hence always appealed most, not to the workers, but to the middle classes. A normal WEA class is composed of professional and trades people, or more likely their wives. As Eric Robinson says in his new book, *The New Polytechnics,*[1] this tradition has been one of offering personal liberation and cultivation to the working classes. Vocational education has been associated with the bad old days, so the adult education has not sought to provide it. This, Mr. Robinson says, has the fundamental assumption that the elite can expect to live through their work but the majority must try to live in spite of their work: liberal education for the workers is conceived as education for leisure. And the interesting thing is that this view has found most adherents among the left.

This is why the Government's policy for polytechnics is so startling. The comprehensive academic communities that the polytechnics are to be, standing at the apex of a system of professional and vocational education, represent a challenge to the old concept of adult education.

1. *The New Polytechnics*, by Eric E. Robinson, Cornmarket, 1968.

Funnily enough, the old concept has simultaneously found new expression in the "Open University". This had its origins at the University of the Air in the campaign speeches of the Labour Party before the 1964 election. After the election the project was given to a Minister of State in the Department of Education and Science who was also responsible for the Arts. The Minister first of all set up an advisory committee which recommended a planning committee which appointed a Vice-Chancellor in June 1968.

The purposes of the new university were set out in a White Paper in February 1966.[1] This purpose was to be threefold. First, it would improve educational, cultural and professional standards generally, by offering "scholarship of a high order". Second, a minority of its audience would want to accept the full disciplines of study, and these students would be able to acquire degrees and other qualifications. Third, it would offer to students elsewhere in the world(!) and particularly in developing countries not only elementary education but training for leadership.

The university would offer not only radio and television lectures but also correspondence courses of unsurpassed quality, all to be "reinforced by residential courses and tutorials". The courses would lead in the first instance to general degrees in arts, social and physical science, particularly subjects of contemporary social, industrial and commercial importance. Students will work towards them through a system of certificates and diplomas to mark each stage of the course, so that even if they drop out they will have something to show for what they have done.

Enrolment is to be open to all, with no formal entry requirement, but there will be an advisory service to tell people whether they can expect to succeed in particular courses. No estimate has been made of the likely audience or number of those going for degrees.

As well as a central administrative centre there are to be a number of regional centres responsible for liaison with other bodies and providing facilities.

What was odd was that in all the planning there was little formal contact between the further education branch of the Department of Education and Science and the branch dealing with the University of the Air. A consequence of this was that quite different policies were produced simultaneously. The University of the Air and Polytechnic White Papers were published within months of each other in 1966 — and neither mentioned the other. It was an unusual example of the lack of collaboration within a Government Department.

The Open University was equally innocent of contact with the broadcasting authorities. It was announced at a press conference that the Open University would have peak viewing time, which was the first the broadcasting authorities had heard of it. No mention was made in the White Paper of the existing educational output on radio and television, and it was not clear whether the Open University would include or replace this.

More astounding, in some ways, was the fact that the Open University's planners did not at any stage consult the Council for National Academic Awards. By 1968 the CNAA had 10,000 students working for its

1. *A University of the Air*, HMSO, 1966.

degrees, more than any British university except London. Not only did it still lack any of the outward appurtenances of a university (like a Vice-Chancellor, which the Open University acquired first) but it was entirely ignored, as was the whole of further education, by the Open University.

It is too early yet to know what will be the outcome of all this. For the purpose of this study it is enough to say that the creation of the Open University underlined the innovatory nature of the polytechnics: the latter could offer, not just general culture, but a new approach to the education of workers, and one which opened newer and more radical possibilities for people and for society.

g) *Evaluation and Planning*

The White Paper of 1966 was called *A Plan for Polytechnics and Other Colleges*,[1] but it is hard to see any planning in it. It was more a statement of intent. In outlining the present position it mentioned "growing numbers of students of 18 and over which are above GCE Advanced level in standard but are not classified as advanced". These students represented the most crucial development of the polytechnics: it was their inclusion which made the "comprehensive". Yet there was no indication in the White Paper of how many of them there were. Similarly, in the paragraph on "future needs" it accepted the projections of the National Plan[2] which in turn derived from the scarcely planned growth of higher education since the Robbins Report.

The familiar arguments for concentrating advanced work were then advanced, and it was recognized that there were also strong arguments, particularly those concerning part-time students, for allowing the growth of advanced work elsewhere than in the selected colleges. The object of the White Paper, it said, "will be to reduce substantially the number of colleges engaged in full-time higher education but colleges not designated as polytechnics will continue to offer full-time courses of higher education where they satisfy the criteria for approval of courses in force from time to time. Existing provision for courses in specific professional fields under nationally settled arrangements will be reviewed in due course. Colleges already engaged in part-time higher education will continue with such work subject to the criteria for approval of courses in forces from time to time. In the absence of exceptional circumstances colleges not already engaged in higher education will not be expected to embark on it". Since then there has been only the circulation of *Notes for Guidance* on setting up a polytechnic, which have been largely confined to governing bodies and other administrative and organisational matters detailed in section (c).

In returning details of their accommodation and courses the colleges were specifically asked not to prepare development plans, but simply to say what was envisaged within the present accommodation and that known to be coming into use.

Nor did the Department of Education and Science seem anxious to use all the instruments available to it to ensure the success of its policy. We have seen how its policies for the salaries of teachers worked directly

1. *Op. cit.*
2. *Op. cit.*

against its policies for polytechnics. The CNAA was grossly undermanned for its new task, both in terms of its permanent officials and of part-time members of its subject boards. The consequence is that colleges are finding serious administrative delays in securing the approval of new courses.

The Government has also given no indication of the resources they are prepared to put into the polytechnics. There are thus no financial implications which are specific to this innovation. It may be, however, that the Department's most serious failure will come to be seen in its inability to ensure serious academic planning in the colleges. Of course it can be argued that academic planning was the business of the individual colleges and that there was nothing to stop it. Equally, the Department has taken the view that until the polytechnics are officially set up, with their governing bodies arranged and their new directors appointed, academic planning could not reasonably be started. But in practice this has meant decisions, affecting the long-term development of the colleges, have been taken in the intervening years in the absence of overall academic plans. At all events only one college, Hatfield, has produced a serious plan, and it cannot be said that any college is showing urgency in emulating this.

CONCLUSIONS

This case study has been about innovation in the public sector of higher education in England and Wales. The impetus for change came originally from Government disenchantment with the contribution of the autonomous sector, the universities, to producing enough appropriately educated technologists. Out of the argument about how this should be done came the National Council for Technological Awards and the colleges of advanced technology. Here there were three significant innovations. The first was the establishment of the sandwich course as a degree-level method of study. Naturally, there had been sandwich courses before but it was left to the NCTA to establish them nationally and to protect their status and standards. The practice of combining academic study and practical experience in a single first-degree course and making of this a coherent educational experience had become weak to the point of atrophy in higher education. The NCTA reintroduced it with a success that astounded both its defenders and detractors. Even now, as universities, the former CATs have retained sandwich courses. Today the Council for National Academic Awards is building upon this experience and extending the sandwich-course principle beyond engineering and other technologies into the social sciences and education for business and management.

Another aspect of the sandwich course development was its contribution to academic freedom. We have seen how since the 1920s staff in technical colleges had, through the national certificate schemes, the opportunity to create and examine courses which were externally assessed and moderated. The principle was introduced into courses of honours-degree level through the NCTA, and this freedom was available to technical colleges while new university colleges in Britain were still expected to offer the degrees of the University of London. Its extension to the NCTA's Diploma in Technology preceded the foundation of most of the new universities. What is more, it offered continuing opportunities for freedom, even to institutions which had hitherto not possessed it.

The second major innovation lay in attempting to create new university-level institutions from existing, less imposing ones. There is a sense in which this had been a familiar historical process: nineteenth century university colleges had in time become independent universities. But few of them had started off with the bewildering variety of kind and level of work which was normal in technical colleges. Nor had they been required to turn themselves into university-level institutions in the space of a very

few years and as a matter of deliberate policy. It is worth emphasizing that most university people thought the attempt doomed from the start. The handicaps of existing staff and methods of government were thought to be too great. In the event, the colleges of advanced technology were largely agreed to be "ready" for formal acceptance as universities only five years after their original designation. This fact alone entirely altered public and official attitudes to the possibilities of the public sector of education. The dominance of the universities in higher education was over.

In their rise the CATs carried into higher education the extension of opportunities that had characterized them as technical colleges. We have seen how the latter had offered the most substantial route to advanced education and professional qualifications for the sons of the manual working classes. In particular they kept open entry to degree-level courses for those qualifying for them by part-time study. Increasingly other universities are now accepting the ordinary national certificate as an entry qualification, a procedure which was pioneered in the CATs. There is no need to overstate the case. The CATs did little for those wishing to study subjects outside technology — or for women. And it is arguable that in becoming universities at all they betrayed their best traditions. But their achievement is there and continues.

The third innovation grew out of the experience of the NCTA and of the CATs, and its success is yet in doubt. The developments we have recorded gave the public sector of higher education a self-confidence which it had hitherto lacked. This, and the growth of numbers coming out of the schools, made possible the notion of a sector of higher education, distinct from the universities and with its own attitudes and traditions, a genuine alternative in fact. The attempt to create "comprehensive academic communities" in the new polytechnics is an expression of the new confidence. The experience of the CATs is extremely influential here, especially in matters of courses and college government. Indeed it is not too much to say that the present attempt to give publicly controlled institutions significant autonomy and freedom is the most important innovation in educational government since the foundation of the University Grants Committee at the turn of the century.

The potential of the new development is even more important. Probably no western European country has yet faced the demand for mass higher education which has become a major preoccupation of the United States. It is just possible that, with the creation of the new polytechnics, England may have placed itself in a position to begin to do so.

Finally, we have been asked to set these conclusions of our study in the context of the parallel studies from the UK and from other countries, and in this our comments arise from the helpful meeting in Paris in Septeber 1968 to discuss our first drafts. It seemed to us then that in terms of the problem-oriented analysis to which the Secretariat had directed our attention, the institutions which have been the subject of our study have been by far the most significantly innovatory. In coping with numbers, in extending educational opportunity to higherto excluded social groups, in creating new structures of study and admitting an interdisciplinary approach,

in institutional management, autonomy and academic freedom, in recruiting different sources of staff, in linking higher education with the outside world and in numbers of lesser ways, English technical education, through the NCTA, the CATs and the polytechnics has made and is making a profound and distinctive social revolution. In all these respects the contribution of universities in most western European countries, including our own, has been tentative and inadequate. We feel bound to agree with our French and Canadian colleagues that significant academic innovation is most likely in institutions which retain the benefits of public control.

STATISTICAL ANNEX

Table 1. ENTRY QUALIFICATIONS OF 1st YEAR STUDENTS ON DIP. TECH. COURSES

	1959[1]	1960	1961	1962	1963	1964
			Numbers			
GCE	(1,529)	1,032	1,253	1,729	2,105	2,293
ONC	(820)	463	451	561	548	866
Other	(168)	31	65	70	62	52
Total	(2,517)	1,526	1,769	2,360	2,715	3,211
			Percentage			
GCE	(61)	68	71	73	78	71
ONC	(33)	30	25	24	20	27
Other	(6)	2	4	3	2	2
Total	100	100	100	100	100	100

1. 1959 based on all students on courses.
Figures at 31st March each year.

Source: NCTA *Reports*, 1960/1 to 1963/4 and NCTA records.

Table 2. NCTA, CLASS OF DIP. TECH. BY METHOD OF ENTRY

Percentage

Method of entry	Total awards to 31.3.62			
	Class of Award			
	Honours		Pass	Total
	1st	2nd		
GCE	12	63	25	100 (629)
ONC/D	17	64	19	100 (400)
Other	24	56	20	100 (63)
Total	14	63	24	101(1,092)

Number of awards shown in brackets.
Source: NCTA records.

Table 3. CITY UNIVERSITY (Northampton CAT)
CLASS OF DIP. TECH. AND SANDWICH DEGREE BY METHOD OF ENTRY

Percentage

Academic Year	1958/9				1959/60				1960/1			
Class of award	Honours 1st	Honours 2nd	Pass	Total	Honours 1st	Honours 2nd	Pass	Total	Honours 1st	Honours 2nd	Pass	Total
Method of entry:												
GCE		*		(2)		*		(27)	17	54	29	100(65)
ONC		*		(3)		*		(15)	9	67	24	100(57)
Academic Year	1961/2				1962/3				1963/4			
Class of award	Honours 1st	Honours 2nd	Pass	Total	Honours 1st	Honours 2nd	Pass	Total	Honours 1st	Honours 2nd	Pass	Total
Method of entry:												
GCE	14	53	33	100(135)	21	59	20	100(89)	16	57	27	100(127)
ONC	23	57	20	100(56)	16	64	20	100(61)	12	65	23	100(52)
Academic Year	1964/5				1965/6				1966/7			
Class of award	Honours 1st	Honours 2nd	Pass	Total	Honours 1st	Honours 2nd	Pass	Total	Honours 1st	Honours 2nd	Pass	Total
Method of entry:												
GCE	15	62	23	100(164)	13	58	30	101(144)	13	63	24	100(175)
ONC	19	61	20	100(59)	13	70	17	100(53)	8	68	24	100(79)

Number of awards in brackets.
* = Numbers too small for percentages.
Source: City University records.

Table 4. BRUNEL UNIVERSITY (BRUNEL CAT)
DIP. TECH. PERFORMANCE AND WASTAGE

a) *Wastage rate*

Percentage

Method of entry	Year of entry					
	1956	1957	1958	1959	1960	All years
GCE	—	38	46	36	47	42
ONC	—	28	25	27	23	26
All entrants	26	33	34	34	42	37

b) *Performance in Dip. Tech. incorporating wastage*
(totals of 1956–1960 entrants)

Method of entry	Honours		Pass	Fail	Total
	1st	2nd			
GCE	9	33	16	42	100(332)
ONC	15	44	15	26	100(119)

Entrants in January added to *previous* September figures.
Wastage calculated as the proportion of *entrants* who fail to gain award whether within prescribed length of course or longer; it does not account for 7 people still on course.
Number of entrants shown in brackets.
Source: Brunel University records.

Table 5. BRADFORD UNIVERSITY (BRADFORD CAT)
WASTAGE RATES OF STUDENTS ON DIP. TECH. COURSES

Percentage

Method of entry	Year of award		Both years
	1964	1965	
GCE	28	39	35
ONC	26	31	29
All entrants	27	37	34

Figures based on cohorts of students entering in 1961 and 1962.
Source: Bradford University records.

Table 6. LOUGHBOROUGH CAT
SCHOOLS ATTENDED BY STUDENTS FROM GREAT BRITAIN

Percentage

	1955/6	1956/7	1957/8	1958/9	1959/60	1960/1	1961/2[1]
Grammar	49	45	41	..	..	44	52
Technical	1	1	1	..	..	3	2
Modern	—	—	—	..	..	—	—
Comprehensive	—	—	—	..	..	—	—
Independent and direct grant ..	37	35	29	..	..	16	10
Technical College	11	17	27	..	..	37	36
Other	2	2	2	..	..	—	—
Numbers	443	451	590	..	..	696	299

1. Entrants only.
.. = Not available.
— = Nil or negligible.
Source: Loughborough University records.

Table 7. NORTHAMPTON CAT (CITY UNIVERSITY)
SCHOOLS ATTENDED BY SANDWICH STUDENTS[1]

Percentage

	1960/1	1961/2	1962/3	1963/4	1964/5	1965/6	1966/7
Grammar	69	68	68	65	63	62	57
Technical	9	10	12	13	14	13	13
Modern	6	6	6	7	7	6	7
Comprehensive	—	—	—	—	—	—	—
Independent and direct grant	14	14	12	12	13	11	11
Technical College	—	—	—	—	—	—	—
Other	2	2	2	3	3	8	12
Numbers	824	901	917	995	1,201	1,391	1,435

1. Nearly all these students were on Dip. Tech. courses in the earlier years. Later they were on degree courses of the university.

— =Nil or negligible.

Source: City University records.

Table 8. BRADFORD CAT (UNIVERSITY)
SCHOOLS ATTENDED BY DIP. TECH. STUDENTS

Percentage

	1962/3	1963/4	1964/5
Grammar	83	71	77
Technical and modern	11	14	12
Comprehensive	—	—	—
Independent and direct grant	5	13	7
Technical college	—	—	—
Other	1	2	4
Numbers	631	859	1,175

– = Nil or negligible.

Source : Bradford CAT, Annual Reports.

Table 9. BIRMINGHAM CAT SCHOOLS ATTENDED BY ENTRANTS TO DIP. TECH. OR SANDWICH DEGREE COURSES

Percentage

	1958/9	1959/60	1960/1	1961/2	1962/3	1963/4	1964/5	1965/6	1966/7
Grammar	60	64	60	64	63	52	–	53	49
Technical	21	14	15	13	13	13	–	3	2
Modern	4	4	5	6	2	5	–	5	7
Comprehensive	–	–	–	1	4	3	–	4	4
Independent and direct grant	14	11	14	7	6	7	–	5	8
Technical college	–	5	5	8	10	15	–	25	24
Other	1	2	1	1	2	5	–	5	6
Total	100	100	100	100	100	100	–	100	100
Total (numbers)	217	260	252	302	308	298	341	423	455

The increase in the technical college figure probably represents a change in the method of collecting figures; in the earlier years some of the school figures may be over-estimated.

Source: Aston University records.

Table 10. NORTHAMPTON CAT
SCHOOLS ATTENDED BY SANDWICH COURSE STUDENTS

Percentage

	1960/1	1961/2	1962/3	1963/4	1964/5	1965/6	1966/7
Grammar	69	68	68	65	63	62	57
Technical	9	10	12	13	14	13	13
Modern	6	6	6	7	7	6	7
Independent and direct grant ..	14	14	12	12	13	11	11
Other	2	2	2	3	3	8	12
Total	100	100	100	100	100	100	100
Total numbers	824	901	917	995	1,201	1,391	1,435

Previous education at technical college excluded.
A few students were not on Dip. Tech. courses.
Source: City University records.

Table 11. BIRMINGHAM CAT
QUALIFICATIONS OF DIP. TECH. ENTRANTS FROM GRAMMAR SCHOOLS

Percentage

	1958/9	1959/60	1960/1	1961/2	1962/3	1963/4
ONC or OND	36	29	24	26	27	34
A levels	61	69	74	74	72	66
Other	3	2	2	—	1	—
Numbers	132	167	150	191	192	155

— = Nil or negligible.
Source: Aston University records.

Table 12. ENROLMENT ON COURSES LEADING TO THE DIP. TECH.

Number and Percentage

	1958	1959	1960	1961	1962	1963	1964
				Engineering[1]			
Men	..	1,847	2,746	3,511	4,153	4,843	5,775
Women	..	16	17	31	25	25	27
Total	990	1,863	2,763	3,542	4,178	4,868	5,802
				Other technologies[2]			
Men	..	619	984	1,319	1,857	2,230	2,667
Women	..	36	67	108	166	212	249
Total	373	655	1,051	1,427	2,023	2,442	2,916
				All subjects			
Men	..	2,466	3,730	4,860	6,010	7,073	8,442
Women	..	52	84	139	191	237	276
Total	1,363	2,518	3,814	4,969	6,201	7,310	8,718

1. Engineering includes mechanical, electrical, civil, chemical engineering, etc.
2. Other technologies include applied chemistry, applied physics, etc. For definitions see any NCTA report.

Figures at 31st March each year.

Source: NCTA *Reports*, 1957–59 to 1963–64.

Table 13. COURSES IN PROGRESS LEADING TO THE DIP. TECH.

Number and Percentage

	1957	1958	1959	1960	1961	1962	1963	1964
CATs	26	28	44	61	65	72	73	74
Other colleges	3	13	22	28	35	36	38	48
Total	29	41	66	89	100	108	111	122
CATs as % of total	90	68	67	68	65	67	66	61
No. of colleges offering courses	9	11	20	23	26	28	28	30

Figures at 31st March each year.

Source: NCTA *Reports*, 1955–57 to 1963–64.

Table 14. ENROLMENTS ON DIP. TECH. COURSES AT CATs AND OTHER COLLEGES

	1961/2	1962/3	1963/4	1964/5
	Number			
CATs	4,304	5,646	6,336	7,302
Other colleges	1,737	1,585	2,103	2,772
Total	6,041	7,231	8,439	10,074
	Percentage			
CATs	71	78	75	73
Other colleges	29	22	25	27
Total	100	100	100	100

Figures as at November each session, hence differ from NCTA totals to 31st March.

Source: Statistics of Education 1961 Part II Table 14
ibid. 1962 Table 14
ibid. 1963, 1964 Table 13

Table 15. AWARDS OF THE DIP. TECH. UP TO 31.3.65 BY CLASS AND COLLEGE

Number and Percentage

College	Class of award							
	1st Class	2nd Class	Pass	Total	1st Class	2nd Class	Pass	Total
	Numbers				Percentage			
Battersea	70	166	84	320	22	52	26	100
Birmingham	97	606	242	945	10	64	26	100
Bradford	20	123	34	177	11	70	19	100
Bristol	16	111	44	171	9	65	26	100
Brunel	66	196	81	343	19	57	24	100
Chelsea	6	12	7	25	—	—	—	—
Loughborough	31	289	93	413	8	70	23	100
Northampton	108	408	182	698	16	58	26	100
Salford	41	259	97	397	10	66	24	100
Welsh	9	71	16	96	9	74	17	100
Total CATs	464	2,241	880	3,585	13	62	25	100
Wolverhampton	17	44	12	73	23	60	17	100
Woolwich	15	117	18	150	10	78	12	100
Others	84	346	90	520	16	67	17	100
Total non-CATs	116	507	120	743	16	68	16	100
GRAND TOTAL	580	2,748	1,000	4,328	13	64	23	100

Sources: NCTA *Reports*, 1957–59 to 1963–64, and NCTA records.

Table 16. AWARDS OF DIP. TECH. AT CATs AND OTHER COLLEGES

	1959		1960		1961		1962		1963		1964		1965	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
CATs (as designated)	34	100	102	79	214	69	482	78	776	84	899	84	976	79
CATs (10 colleges) ...	34	100	106	82	268	87	526	85	776	84	899	84	976	79
Other colleges..	—	—	23	18	41	13	94	15	151	16	174	16	260	21
Total	34	100	129	100	309	100	620	100	927	100	1,073	100	1,236	100

Awards as at 31st March each year.
CATs (as designated) excludes two colleges that later became CATs — Bristol up to 1960 and Brunel up to 1962. CATs (10 colleges) includes all ten colleges that eventually became CATs.
1965 figures include CNAA awards.

Source: NCTA *Reports*, 1957–59 to 1963–64.

Table 17. TOTAL NUMBER OF AWARDS OF DIP. TECH. UP TO 31.3.63

Subject	1st Class	2nd Class	Pass	Total
		Dip. Tech.		
Applied biochemistry	1	1	—	2
Applied biology	4	33	25	62
Applied chemistry, etc.	62	333	92	487
Applied mathematics	20	65	41	126
Applied pharmacology	2	10	2	14
Applied physics	56	239	120	415
Total Dip. Tech.	145	681	280	1,106
		Dip. Tech. (Eng.)		
Aeronautical engineering	27	148	35	210
Building	—	26	4	30
Chemical engineering	25	94	14	133
Civil engineering	24	82	35	141
Electrical engineering	140	813	301	1,254
Instrument and control engineering	4	20	8	32
Mechanical engineering	170	605	240	1,015
Metallurgy	24	116	17	157
Naval architecture	4	1	1	6
Production engineering	17	162	65	244
Total Dip. Tech. (engineering)	435	2,067	720	3,222
Grand total	580	2,748	1,000	4,328

Source: NCTA records.

Table 18. BIRMINGHAM CAT (ASTON UNIVERSITY) WASTAGE ON DIP. TECH. COURSES

Number and percentage

	1st year of course			
	1961/62	1962/63	1961/62	1962/63
	Dip. Tech. (Eng.)		*Dip. Tech.*	
Entrants [1]	234	259	85	56
Awards [2]	161	180	53	39
Wastage (per cent)	31.2	30.5	32.9	30.5

Wastage calculated as the proportion of *entrants* who fail to gain award whether within prescribed length of course or longer.

1. Includes direct entrants to 2nd and 3rd years.
2. Includes awards to all entrants who eventually completed the course.

Source: Aston University records.

Table 19. ALL STUDENTS IN ALL F.E. ESTABLISHMENTS AND CATs (as designated) 1956–64

Thousands and percentage

	1956/7	1957/8	1958/9	1959/60	1960/1	1961/2	1962/3	1963/4	1964/5
					Full-time				
All	62.7	72.6	91.0	98.2	106.2	118.8	140.7	156.7	167.3
CATs	4.7	4.7	4.8	4.8	4.7	4.7	4.8	4.8	6.0
Percentage CATs	7.5	6.5	5.3	4.9	4.4	4.0	3.4	3.1	3.6
					Sandwich				
All	4.0	6.5	18.5	10.0	11.3	13.3	16.0	18.9	22.2
CATs	1.1	2.1	2.5	3.0	3.8	4.5	6.2	7.0	8.1
Percentage CATs	27.5	32.3	29.4	33.3	33.6	33.8	38.8	37.0	36.5
					Part-time day				
All	421.8	437.0	443.6	452.3	487.8	556.0	601.5	613.3	648.3
CATs	11.5	10.1	5.7	5.6	6.3	6.5	5.9	5.0	4.1
Percentage CATs	2.7	2.3	1.3	1.2	1.3	1.2	1.0	0.8	0.6
					Evening only				
All	1,415.8	1,410.1	1,480.5	1,495.4	1,590.1	1,746.3	1,856.9	1,854.5	1,909.9
CATs	14.8	12.8	8.4	9.1	9.7	9.3	7.9	5.2	4.6
Percentage CATs	1.0	0.9	0.6	0.6	0.6	0.5	0.4	0.3	0.2
					Total				
All	1,904.3	1,926.2	2,023.6	2,055.9	2,195.4	2,434.4	2,615.1	2,643.3	2,747.7
CATs	32.1	29.6	21.4	22.6	24.6	25.0	24.8	22.0	22.8
Percentage CATs	1.7	1.5	1.1	1.1	1.1	1.0	0.9	0.8	0.8

Source: Statistics of Education, Part II, 1964, Table 9.

Table 20. ADVANCED STUDENTS IN ALL F.E. ESTABLISHMENTS AND CATs (as designated) 1956–64

Thousands and percentage

	1956/7	1957/8	1958/9	1959/60	1960/1	1961/2	1962/3	1963/4	1964/5
					Full-time				
All	9.32	10.44	13.37	14.84	16.68	20.96	24.11	28.13	33.55
CATs	3.45	3.58	3.77	3.68	3.82	3.88	4.06	4.52	5.70
Percentage CATs	37.0	34.3	28.8	24.8	22.9	18.5	16.8	16.1	18.0
					Sandwich				
All	3.62	5.84	7.57	8.93	10.09	11.73	14.19	16.65	19.90
CATs	1.08	2.06	2.48	2.99	3.69	4.54	6.24	6.98	8.12
Percentage CATs	29.8	35.3	32.8	33.5	36.6	38.7	44.0	41.9	40.8
					Part-time day				
All	34.50	37.59	37.36	38.88	42.12	47.95	50.21	53.21	56.96
CATs	5.17	5.13	5.02	4.64	5.33	5.43	5.06	4.53	3.65
Percentage CATs	15.0	13.7	13.4	11.9	12.7	11.3	10.1	8.5	6.4
					Evening only				
All	..	..	31.36	30.82	35.37	45.93	50.00	49.56	47.74
CATs	..	..	3.90	3.36	3.76	4.16	3.66	2.64	2.22
Percentage CATs	..	..	10.4	10.9	10.6	9.6	7.3	5.3	4.7
					Total				
All	47.44	53.87	89.66	93.47	104.26	126.57	138.51	147.54	158.14
CATs	9.70	10.77	15.16	14.67	16.60	18.01	19.02	18.67	19.69
Percentage CATs	..	..	16.91	15.7	15.9	15.2	13.7	12.7	12.5

Totals do not include evening only 1956, 1957. Figures for Autumn term.

Source: *Statistics of Education*, Part II, 1964, Table 9.

Table 21. STUDENTS AT CATs (as designated) 1956–64

Thousands and percentage

	1956/7	1957/8	1958/9	1959/60	1960/1	1961/2	1962/3	1963/4	1964/5
					Full-time				
All	4.67	4.66	4.83	4.84	4.71	4.72	4.83	4.83	5.97
Advanced	3.45	3.58	3.77	3.68	3.82	3.88	4.06	4.52	5.70
Percentage advanced	73.9	76.8	78.1	76.0	81.1	82.2	84.1	93.6	95.5
					Sandwich				
All	1.09	2.06	2.50	3.03	3.77	4.54	6.24	6.98	8.12
Advanced	1.08	2.06	2.48	2.99	3.69	4.54	6.24	6.98	8.12
Percentage advanced	99.1	100.0	99.2	98.7	97.9	100.0	100.0	100.0	100.0
					Part-time day				
All	11.53	10.09	5.66	5.62	6.33	6.45	5.86	5.01	4.07
Advanced	5.17	5.13	5.02	4.64	5.33	5.43	5.06	4.53	3.65
Percentage advanced	44.8	50.8	88.7	82.6	84.2	84.2	86.4	90.4	89.7
					Evening only				
All	14.84	12.80	8.41	9.14	9.74	9.30	7.87	5.16	4.60
Advanced	..	..	3.90	3.36	3.76	4.16	3.66	2.64	2.22
Percentage advanced	..	..	46.4	36.8	38.6	44.7	46.5	51.2	48.3
					Total				
All	32.13	29.59	21.40	52.63	24.56	25.02	24.80	21.98	22.76
Advanced	9.70	10.77	15.16	14.67	16.60	18.01	19.02	18.67	19.69
Percentage advanced	..	..	70.8	64.8	67.6	72.0	76.7	84.9	86.5

Totals exclude evening only in 1956 and 1957. Figures for Autumn term.

Source: Statistics of Education, Part II, 1964, Table 9.

Table 22. ALL STUDENTS AT CATs (as designated)

Percentage

	1956/7	1957/8	1958/9	1959/60	1960/1	1961/2	1962/3	1963/4	1964/5
Full-time	14.5	15.7	22.6	21.4	19.2	18.9	19.5	22.0	26.2
Sandwich	3.4	7.0	11.7	13.4	15.4	18.1	25.2	31.8	35.7
Full-time and sandwich	17.9	22.7	34.3	34.8	34.6	37.0	44.7	53.8	61.9
Part-time day	35.9	34.1	26.4	24.8	25.8	25.8	23.6	22.8	17.9
Evening only	46.2	43.2	39.3	40.4	39.6	37.2	31.7	23.4	20.2
All part-time	82.1	77.3	65.7	65.2	65.4	63.0	55.3	46.2	38.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Statistics of Education, Part II, 1964, Table 9.

Table 23. ADVANCED STUDENTS AT CATs (as designated)

Percentage

	1956/7	1957/8	1958/9	1959/60	1960/1	1961/2	1962/3	1963/4	1964/5
Full-time	..	..	24.8	25.1	23.0	21.5	21.4	24.2	29.0
Sandwich	..	..	16.4	20.4	22.2	25.2	32.8	37.4	41.2
Full-time and sandwich	..	..	41.2	45.5	45.2	46.7	54.2	61.6	70.2
Part-time day	..	..	33.1	31.6	32.1	30.2	26.6	24.3	18.5
Evening only	..	..	25.7	22.9	22.7	23.1	19.2	14.1	11.3
Total part-time	..	..	58.8	54.5	54.8	53.3	45.8	38.4	29.8
Total	..	..	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Statistics of Education, Part II, 1964, Table 9.

Table 24. ENROLMENTS BY METHOD OF STUDY AT THE CATs, 1955/6 and 1965/6

	Full-time and sandwich				Part-time				Total	
	Number		Percentage		Number		Percentage		Number	
	1955/6	1965/6	1955/6	1965/6	1955/6	1965/6	1955/6	1965/6	1955/6	1965/6
Battersea	900	1,803	32	89	1,888	232	68	11	2,788	2,035
Birmingham	753	2,059	10	67	7,201	1,034	90	33	7,954	3,093
Bradford[1]	(476)	2,294	(9)	98	(4,995)	54	(91)	2	(5,471)	2,348
Bristol	310	1,190	5	82	6,554	263	95	18	6,854	1,453
Brunel	..	903	..	85	..	158	..	15	..	1,061
Chelsea	783	928	29	55	1,934	669	71	45	2,717	1,697
Loughborough	810	1,762	100	100	—	—	—	—	810	1,762
Northampton	451	1,860	11	95	3,831	108	89	5	4,282	1,968
Salford	556	2,402	9	69	5,491	1,061	91	31	6,047	3,463
Wales	921	1,105	14	51	5.604	1,068	86	49	6,525	2,173

1. Figures for 1956–57.

Sources: 1955–56 returns to the DES and college records 1965–66 — UGC *Returns*, 1965–66.

Table 25. NORTHAMPTON CAT, HOME ADDRESSES OF STUDENTS

Percentage

	1955/6	1956/7	1957/8	1958/9	1959/60	1960/1	1961/2	1962/3	1963/4 to 1966/7	1967/8
					Full-time and sandwich					
London (LCC)	14	15	16	15	9	12	10	10	..	8
Home counties	43	43	48	50	49	43	45	47	..	49
Rest of Britain	21	21	24	20	29	38	39	38	..	40
Other	22	21	12	15	13	7	6	5	..	3
Number	451	527	772	1,073	1,292	1,354	1,408	1,390	..	2,107
					Total					
London (LCC)	45	41	31	22	18	17	16	15	..	..
Home counties	48	51	54	58	55	51	50	51	..	..
Rest of Britain	5	6	12	14	20	28	30	31	..	..
Other	2	2	3	6	7	4	4	3	..	..
Number	4,270	4,162	2,667	2,571	2,502	2,298	2,194	1,976	..	..

Source: City University records.

Table 26. BATTERSEA CAT HOME ADDRESSES OF FULL-TIME AND SANDWICH STUDENTS

Percentage

	1955/6	1956/7	1957/8	1958/9	1959/60	1960/1	1961/2	1962/3	1963/4	1964/5
Greater London (GLC area)	65	65	63	60	40	40	26	25	23	27
Rest of Britain	35	35	37	40	60	60	62	64	65	61
Overseas	*	*	*	*	*	*	12	11	12	12
Number	1,150	1,217	1,288	1,274	1,631	1,584	1,335	1,321	1,375	1,406

* = Included in above.

Source: Battersea CAT, *Annual Reports*, 1955–56 to 1964–65.

Table 27. RESIDENCE OF FULL-TIME AND SANDWICH[1] STUDENTS AT CATs AND UNIVERSITIES, 1965/66

	Percentage			Total	
	Hall	Lodgings	Home	Percentage	Number
Battersea	19.4	50.1	30.5	100.0	1,658
Birmingham	12.2	44.0	43.8	100.0	1,654
Bradford	24.2	51.7	24.1	100.0	1,863
Bristol	—	74.0	26.0	100.0	1,116
Brunel	5.3	50.4	44.3	100.0	686
Chelsea	19.9	46.4	33.7	100.0	916
Loughborough	92.8	6.9	0.3	100.0	1,500
Northampton	36.7	26.5	36.8	100.0	1,237
Salford	27.2	39.3	33.5	100.0	1,853
Wales	16.5	58.3	25.2	100.0	1,065
Total CATs	27.4	43.6	29.0	100.0	13,548
Universities[2]	38.5	50.2	11.3	100.0	124,914

1. Excluding students in industrial training.
2. Includes universities and colleges in England and Wales, excludes former CATs.

Source: UGC *Returns*, 1965–66.

Table 28. SEX OF ALL STUDENTS AT CATs (AS DESIGNATED)

Number and percentage

	1958/9	1959/60	1960/1	1961/2	1962/3	1964/4	1964/5	1965/6
Full-time								
Men	4,612	4,574	4,062	3,898	4,165	3,777	4,775	..
Women	666	713	652	821	669	704	913	..
Percentage women ...	12.6	13.5	13.8	17.4	13.8	15.7	16.1	..
Sandwich								
Men	2,462	2,972	2,399	4,410	5,986	6,674	7,716	..
Women	39	49	58	135	253	306	401	..
Percentage women ...	1.6	1.6	2.4	3.0	4.1	4.4	4.9	..
Part-time day								
Men	5,736	5,597	5,962	6,030	5,472	4,591	3,804	..
Women	458	446	368	420	384	419	268	..
Percentage women ...	7.4	7.3	5.8	6.5	6.6	8.2	6.6	..
Evening only								
Men	9,903	10,640	8,521	8,203	7,453	4,779	4,273	..
Women	1,284	1,511	1,224	1,100	419	380	331	..
Percentage women ...	11.5	12.4	12.6	11.8	5.3	7.4	7.2	..
Total								
Men	22,713	23,883	20,944	22,541	23,076	19,821	20,568	18,887
Women	2,447	2,719	2,302	2,476	1,725	1,809	1,913	2,056
Percentage women ...	9.7	10.2	9.9	9.9	7.0	8.4	8.5	9.8

Source: Statistics of Education, Part II, except 1965–66; UGC *Returns*, 1965–66.

Table 29. BIRMINGHAM CAT, SEX OF ALL STUDENTS

Number and percentage

	1956/7	1957/8	1958/9	1959/60	1960/1	1961/2	1962/3	1963/4	1964/5	1965/6	1966/7
Full-time											
Men	307	390	168	186	129	221	206	314	486	725	830
Women	198	60	47	51	44	45	55	73	77	110	142
Percentage women ...	39.2	13.3	21.9	21.5	25.4	16.9	21.1	18.9	13.7	13.2	14.6
Sandwich											
Men	351	590	696	814	824	892	983	996	1,043	1,161	1,256
Women	5	9	14	13	17	22	30	29	38	37	52
Percentage women ...	1.4	1.5	1.9	1.6	2.0	2.4	3.0	2.8	3.5	3.1	4.0
All part-time											
Men	5,473	6,169	2,312	2,290	2,449	2,480	2,229	1,937	1,519	1,028	727
Women	1,029	223	34	40	34	36	38	55	44	20	20
Percentage women ...	15.8	3.5	1.5	1.7	1.4	1.4	1.7	2.8	2.8	1.9	2.7
Total											
Men	6,131	7,129	3,176	3,290	3,402	3,594	3,418	3,247	3,048	2,914	2,813
Women	1,232	292	95	104	95	103	123	157	159	167	214
Percentage women ...	16.7	3.9	2.9	3.1	2.7	2.9	3.5	4.6	5.0	5.4	7.1

Source: Aston University records.

Table 30. WELSH CAT, SEX OF ALL STUDENTS

Number and percentage

	1955/6	1956/7	1957/8	1958/9	1959/60	1960/1	1961/2	1962/3	1963/4	1964/5	1965/6
Full-time											
Men	541	628	815	419	555	539	491	..	(191)	(221)	(224)
Women	293	175	130	146	176	170	83	..	(30)	(37)	(41)
Percentage women	35.1	21.8	13.8	25.8	24.1	24.0	14.5	..	13.6	14.3	15.5
Sandwich											
Men	87	133	115	152	182	197	295	..	(135)	(132)	(132)
Women	—	—	—	2	2	1	1	..	(3)	(6)	(8)
Percentage women	—	—	—	1.3	1.1	0.5	0.3	..	2.2	4.4	5.7
Part-time day											
Men	941	686	514	465	605	621	548	..			
Women	309	294	55	30	33	42	53	..		All part-time	
Percentage women	24.7	27.2	9.7	6.1	5.2	6.3	8.8	..			
Evening only											
Men	2,628	1,894	1,511	1,688	1,738	1,584	1,045	..	(643)	(442)	(538)
Women	1,816	1,087	757	798	729	695	53	..	(87)	(106)	(77)
Percentage women	40.1	36.5	33.4	32.1	29.6	30.5	4.8	..	11.9	19.3	12.5
Total											
Men	4,197	3,341	2,955	2,796	3,080	2,941	2,379	..	(994)	(836)	(995)
women	2,418	1,556	942	976	940	908	190	..	(131)	(158)	(150)
Percentage women	36.6	31.8	24.2	25.9	23.4	23.6	7.4	..	11.6	15.9	13.6

Figures 1955–56 to 1961–62 for all students; 1963–64 to 1965–66 for all students, but excluding part-time post-graduates.
Source: Welsh CAT records.

Table 31. CHELSEA CAT, SEX OF ALL STUDENTS

Number and percentage

	1955/6	1956/7	1957/8	1958/9	1959/60	1960/1	1961/2	1962/3	1963/4	1964/5	1965/6
Full-time											
Men	..	Full-time and Sandwich		509	516	579	579	567	586	660	Full-time and Sandwich
Women	..			148	144	122	129	146	171	172	
Percentage women	..			22.5	20.0	17.4	18.2	20.5	22.6	20.7	
Sandwich											
Men	..	(457)	(423)	37	50	48	68	52	53	45	(568)
Women	..	(149)	(137)	—	2	2	7	4	5	9	(179)
Percentage women	..	(24.6)	(24.5)	—	3.8	4.0	9.3	7.1	8.6	16.7	(24.0)
Part-time day											
Men	..	245	209	209	181	177	173	136	106	166	(27)
Women	..	54	50	51	39	28	28	24	23	19	(6)
Percentage women	..	18.1	19.3	19.6	17.7	13.7	13.9	15.0	17.8	10.3	(18.2)
Evening only											
Men	..	973	696	695	862	937	649	670	707	361	..
Women	..	242	153	146	262	200	129	100	96	65	..
Percentage women	..	19.9	18.0	17.4	23.3	17.6	16.6	13.0	12.0	15.3	..
Total											
Men	..	1,675	1,328	1,450	1,669	1,741	1,469	1,425	1,452	1,232	(595)
Women	..	445	340	345	447	352	293	274	295	265	(185)
Percentage women	..	21.0	20.4	19.2	21.1	16.8	16.6	16.1	16.9	17.7	(23.7)

1965–66 figures for first degree students only.

Source: Returns to DES, 1956–57 to 1964–65 and *Annual Report*, 1965–66.

Table 32. AGE OF ALL STUDENTS AT CATs (AS DESIGNATED)

I. Number

	1958/9	1959/60	1960/1	1961/2	1962/3	1963/4	1964/5	1965/6
Full-time								
Under 18	157	134	130	80	21	25	20	(UGC)
18	448	441	486	374	392	366	623	Full-time
19	746	710	696	715	773	881	976	(incl.
20	690	746	772	601	713	869	1,136	sand-
21 and over ..	3,237	2,808	2,630	2,949	2,935	2,340	2,933	wich)
Sandwich								
Under 18	48	34	34	19	18	20	32	49
18	375	273	308	468	738	687	885	2,263
19	579	461	521	877	1,344	1,630	1,603	3,385
20	566	482	602	902	1,343	1,615	1,893	2,864
21 and over ..	933	855	992	2,279	2,796	3,028	3,704	7,745
Part-time day								
Under 18	138	83	103	70	19	22	8	..
18	327	204	310	273	196	141	57	..
19 . .	660	387	506	482	503	376	208	..
20	834	663	875	638	693	582	537	..
21 and over ..	4,235	3,085	4,536	4,987	4,445	3,895	3,262	..
Evening only								
Under 18	234	261	260	218	7	3	4	..
18	168	216	201	154	45	12	22	..
19	194	202	175	172	62	32	23	..
20	231	226	252	167	108	62	261	..
21 and over ..	10,360	8,238	8,857	8,592	7,650	5,050	4,294	..
Total								
Under 18	577	512	527	387	65	70	64	..
18	1,318	1,134	1,305	1,269	1,371	1,206	1,587	..
19	2,179	1,760	1,898	2,246	2,682	2,919	2,810	..
20	2,321	2,117	2,501	2,308	2,857	3,128	3,827	..
21 and over ..	18,565	14,986	17,015	18,807	17,826	14,313	14,193	..

1958–59 figures for full year's enrolments. Others for enrolments in October (1959–60) and November (1960–61 to 1964–65). Age as at 1st August 1958, 1959, 1960, 31st December 1961, 1962, 1963, 1964.

Sources: *Statistics of Education*, 1959, Table 59 *et seq.* and UGC *Returns*, 1965–66.

Table 32. AGE OF ALL STUDENTS AT CATs (AS DESIGNATED)

II. Percentage

	1958/9	1959/60	1960/1	1961/2	1962/3	1963/4	1964/5	1965/6
Full-time								
Under 18	3	3	3	1	–	1	–	(UGC)
18	9	9	10	8	8	8	11	Full-time
19	14	15	15	15	16	20	17	(incl.
20 . ..	13	15	16	13	15	19	20	sand-
21 and over ..	61	58	56	63	61	52	52	wich)
Sandwich								
Under 18	2	2	1	1	–	1	–	–
18	15	13	13	10	12	10	11	14
19	23	22	21	19	22	23	20	21
20	23	23	25	20	22	23	23	18
21 and over ..	37	40	40	50	45	43	46	47
Part-time day								
Under 18	2	2	1	1	–	–	–	..
18	5	5	5	4	3	3	1	..
19	11.	9	8	7	9	8	5	..
20	14	15	14	10	12	12	13	..
21 and over .	68	69	72	77	76	78	80	..
Evening only								
Under 18	2	3	3	2	–	–	–	..
18	2	2	2	2	1	–	–	..
19	2	2	2	2	1	1	1	..
20	2	3	2	2	1	1	6	..
21 and over ..	92	90	91	92	97	98	93	..
Total								
Under 18	2	3	2	1	–	–	–	..
18	5	6	6	5	6	6	7	..
19	9	8	8	9	11	13	13	..
20	9	9	11	10	11	15	17	..
21 and over ..	75	74	73	75	72	66	63	..

1958–59 figures for full year's enrolments. Others for enrolments in October (1959–60) and November (1960–61 to 1964–65). Age as at 1st August 1958, 1959, 1960, 31st December 1961, 1962, 1963, 1964.

Sources: *Statistics of Education*, 1959, Table 59 *et seq.* and UGC *Returns*, 1965–66.

Table 33. FURTHER EDUCATION

	BURNHAM 1954	BURNHAM 1956	
	All colleges of further education	Colleges of further education	CATs
Assistants			
Grade A	£450 x £18 – £725 (final increment £23)	£475 x £25 – £900	
Grade B	£525 x £25 – £820 (final increment £20)	£650 x £25 – £1,025 [1]	£650 x £25 – £1,025 [1]
Lecturers	£965 x £25 – £1,065	£1,200 x £30 – £1,350	£1,200 x £30 – £1,350
Senior lecturers	£1,065 x £25 – £1,215 [2]	£1,350 x £50 – £1,550 [2]	£1,350 x £50 – £1,550
Principal lecturers	.	.	.
Readers	.	.	£1,550 x £50 – £1,800 [3]
Heads of Depts.			
I	£965 x £25 – £1,065	£1,250 x £30 – £1,400	.
II	£1,065 x £25 – £1,215	£1,400 x £50 – £1,600	.
III	£1,215 x £25 – £1,365	£1,600 x £50 – £1,750	£1,600 x £50 – £1,750
IV	£1,365 x £25 – £1,515	£1,750 x £50 – £1,900	£1,750 x £50 – £1,900
V	£1,515 x £25 – £1,665 [2]	£1,900 x £50 – £2,050 [2]	£1,900 x £50 – £2,050
VI	.	.	£2,050 x £50 – £2,250 [2]
VII	.	.	.
Vice Principals	£50 – £200 a year over salary	£100 – £250 a year over salary	To be agreed with LEA and Minister
Principals	To be agreed with LEA and Minister	As before	As before
Additions	Training £18 (max.3 increments)	£25	£25
	Graduate £60	£75	£75
	Good Honours £30	£50	£50

1. Possible allowance for administrative duties of £100 a year.
2. In special circumstances or particular cases the IEA (with agreement of the Minister) could pay such higher salary as it deemed appropriate.
3. Maximum could be increased subject to Ministerial approval.
4. Many scales: this one is typical.

AND CAT SALARY SCALES 1954 TO 1964

BURNHAM 1963			NIC 1964
CATs			CATs and universities
£1,000 x £30(12) x £40 x £60(3) - £1,580 [4]		Assistant lecturers	£1,050 x £75 - £1,275
£1,600 x £40	- $1,800	Lecturers	£1,400 x £85 - £2,505
£1,800 x £50(2) x £60(3) x £70	- £2,150		
£2,150 x £75	- £2,375	Senior lecturers and Readers	Range of salaries with varying maxima up to £3,250
£2,250 x £75	- £2,700		
£2,400 x £75	- £2,625	Professors	Minimum £3,400
£2,625 x £75	- £2,850		Maximum £4,750
£2,850 x $75	- £3,100		
£3,100 x £75	- £3,400		
To be agreed with Minister		Vice Principal	As before
To be agreed with Minister		Principal	As before
-		None	
£100			
£100			

Sources: Ministry of Education: *Report of the Burnham Committee on Scales of Salaries for Teachers in Establishments of Further Education*, 1954, 1956, 1963, HMSO, London.
National Incomes Commission, *Report No. 3*, HMSO, 1964.

Table 34. STAFF IN THE CATs
1956 and 1966

Numbers and percentages

College	1956	1966	Percentage increase
Battersea	105	272	160
Birmingham	168	396	140
Bradford	91	396	340
Bristol	127	234	80
Brunel	.	174	–
Chelsea	67	136	100
Loughborough[1]	58	265	360
Northampton	99	257	160
Salford	148	331	120
Welsh	96	1,185	90
Total	958	2,646	260

1. Excludes workshop instructors.
Source: Staff survey.

Table 35. ENTRANTS AND LEAVERS IN THE TEN COLLEGES
1956 TO 1966

Numbers

	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
Entrants	124	169	222	221	265	263	336	317	337	297	225
Leavers	45	87	114	108	191	86	88	112	104	137	143
All staff	849	940	1,068	1,188	1,333	1,501	1,731	1,926	2,146	2,292	2,365

Note: Excludes Brunel 1956–1960.
Source: Staff survey.

Table 36. QUALIFICATIONS HELD BY TEACHERS IN CATs
1956 AND 1966

Percentage

	1956			1966		
	Men	Women	Total	Men	Women	Total
First degree	72	49	68	90	87	90
Dip. Tech. (incl. in above)	–	–	–	2	1	2
Higher degree (incl. in above)	33	25	29	44	34	44
Professional Qualification	..	..	66	..	..	57
Number (= 100 %)	726	69	794	2 480	159	2 639
Not known (% of grand total	6	8	6	2	3	2
Grand total	773	74	874	2 523	164	2 687

Source: Staff survey.

Table 37. QUALIFICATIONS HELD BY STAFF RECRUITED TO AND LEAVING THE CATs (AS DESIGNATED)
1956–1966

Percentage

	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
Recruits											
First degree	73	81	89	90	90	89	89	94	94	95	95
Higher degree ...	27	34	44	43	47	40	43	6	41	50	43
Number (= 100 %)	122	165	216	213	260	255	321	301	326	288	208
Not known (% of grand total) ..	1	2	2	2	1	3	3	4	3	2	6
Grand total	123	168	219	217	262	262	320	315	336	294	222
Leavers											
First degree	..	54	53	74	71	84	82	86	89	87	95
Higher degree ..	..	22	14	27	23	33	35	26	36	33	36
Number (= 100 %)	..	79	100	92	107	82	79	101	91	123	135
Not known (% of grand total)	..	2	4	4	9	5	8	9	13	10	6
Grand total	..	81	104	96	118	86	86	111	104	136	143

Note: First degree includes Dip. Tech.
Source: Staff survey.

Table 38. AGE OF STAFF IN CATs, FE, REGIONAL COLLEGES AND UNIVERSITIES

Percentage

	Under 30	30–39	40–49	Over 50	Total
CATs					
1956	15	41	28	16	100
1966	17	44	27	12	100
All further education					
1956	13	35	32	20	100
1966[1]	15	36	29	20	100
Regional Colleges					
1966	22	41	23	14	100
Universities (All)					
1962	19	37	25	19	100
Applied science					
1962	19	43	23	15	100

1. Excluding CATs.
Source: CATs – Staff survey.
FE – Statistics of Education, 1961, Part One, Table 44, and 1966, Vol. 4, Table 33.
Universities – Robbins Report.
Regional Colleges – AUT/ATTI Sample Survey 1966.

Table 39. LENGTH OF SERVICE OF TEACHERS IN THE CATs AND REGIONAL COLLEGES

Percentage

Length of service in years	1956	1966	
	CATs	CATs	Regional Colleges
0– 4	48	51	43
5– 9	30	30	28
10–14	11	9	14
15–19	4	6	
20–24	2	3	
25–29	2	1	15
30–34	1	–	
35–39	2	–	
40 and over	–	–	
Number (= 100 %)	719	2 623	2 247
Not known (% of grand total)	14	1	–
Grand total	832	2 646	–

Note: CATs in 1956 – 8 colleges.
CATs in 1966 – 10 colleges.

Source: CATs – Staff survey.
Regional Colleges – AUT/ATTI Sample survey 1966.

Table 40. STAFF IN TEACHING GRADES RECRUITED TO THE CATs 1956–1966

Percentage

	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
Professor	.	.	.	.	.	.	.	.	–	11	11
Head Reader ...	3	2	4	2	2	1	2	2	.	.	.
Reader	.	1	3	2	2	3	4	5	6	4	3
Principal lecturer	.	.	.	.	1	3	3	2	.	.	.
Senior lecturer ..	7	18	12	13	16	11	14	9	8	5	6
Lecturer	40	41	53	50	47	52	45	49	60	53	65
Assistant/assistant lecturer ..	50	38	28	33	32	30	32	33	26	27	15
Number (= 100 %)	124	167	219	210	253	236	287	255	256	221	144

Source: Staff survey.

Table 41. TEACHING STAFF THAT LEFT THE CATs
1957–1966

	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
Professor	.	.	.	.	.	.	.	.	1	6
Head	6	8	11	5	5	5	–	5	1	.
Reader	–	2	1	1	1	5	2	2	6	4
Principal lecturer	.	.	–	2	3	1	11	–	–	–
Senior lecturer ..	15	13	11	22	30	25	22	21	10	6
Lecturer	28	34	37	30	37	35	45	48	52	65
Assistant/assistant lecturer ..	51	43	39	40	24	29	20	24	30	18
Number (=100%)	81	104	97	118	79	80	86	81	94	109

Notes: Up to 1963 Burnham grades. 1964–1966 NIC grades.
Source: Staff survey.

Table 42. PERCENTAGE OF POSTS IN THE CATs FILLED BY RECRUITMENT FROM OUTSIDE
1956–1966

Percentage

	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
Professor	.	.	.	.	.	.	.	.	..	46	(75)
Head	(38)	(30)	(69)	(38)	(71)	(23)	(32)	(60)	..	.	.
Reader	.	(50)	(35)	(63)	(40)	(50)	(61)	(68)	..	(41)	(57)
Principal lecturer	.	.	.	–	11	16	23	14	..	.	.
Senior lecturer .	26	50	33	36	47	30	35	28	..	21	35
Lecturer	63	69	70	67	76	72	74	74	..	68	75
Assistant/ assistant lecturer ..	100	100	100	100	100	99	99	93	..	91	92

Notes: Number in brackets based on totals of less than 20. Up to 1963, Burnham grades, 1965–1966 NIC grades. Assimilation to NIC scale makes 1964 figures incalculable.
Source: Staff survey.

Table 43. PREVIOUS EMPLOYMENT OF STAFF IN THE EIGHT COLLEGES, 1956 AND TEN COLLEGES 1966

	Percentage	
	1956	1966
University	8	15
CAT	1	3
Technical college	22	15
School	11	5
Other educational	3	3
All educational	45	41
Industry	32	35
Professions, etc.	8	7
First appointment	9	13
Other	6	4
Number (= 100%)	659	2,535
Not known (% of grand total)	21	4
Grand total	832	2,646

Source: Staff survey.

Table 44. ORIGIN OF RECRUITS TO TEACHING STAFF IN THE CATs, BY GRADE, 1956–1966

	Professor	Head	Reader	Princ. lect.	Senior lect.	Lecturer	Assistant lect./ Assistant
Education							
University	54	53	32	8	15	14	12
CAT	–	2	4	12	8	4	1
Tech. college	3	15	10	19	29	17	8
School	–	–	–	–	2	4	7
Other	8	2	4	15	1	4	2
Industry	24	18	35	23	35	40	31
Other	11	10	15	23	9	17	39
Number (= 100%)	37	40	74	26	245	1,109	618
Not known (% of grand total)	3	9	6	–	4	4	11
Grand total	38	44	79	26	256	1,151	693

Note: Grades include both Burnham and NIC grades.
Source: Staff survey.

Table 45. DESTINATION OF STAFF (ALL GRADES) THAT LEFT THE CATs
1957–1966

Percentage

	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
Education										
University	7	8	23	22	28	15	18	23	33	31
CAT	9	4	7	4	9	4	1	7	2	4
Tech. Coll. ...	44	68	30	31	33	36	33	19	7	21
School	2	1	–	2	–	–	3	2	2	2
Other	7	5	3	7	4	11	4	3	10	3
Industry	7	4	7	16	13	13	13	17	21	10
Professions, etc.	–	1	5	5	–	–	–	4	3	2
Died	2	4	7	2	2	2	3	4	5	9
Retired	11	4	12	7	7	13	15	6	5	6
Other	11	1	5	4	4	6	10	15	12	12
Number (= 100 %)	45	77	40	55	54	47	72	69	89	47
Not known (% of grand total)	44	26	59	53	37	45	35	34	35	32
Grand total	81	104	97	118	86	86	111	104	136	143

Source: Staff survey.

Table 46. PREVIOUS EMPLOYMENT OF STAFF WHO LEFT THE CATs FOR POSTS IN EDUCATION AND INDUSTRY
1956–1966

Percentage

From \ To	Academic					Industry
	University	CAT	Tech. coll.	School	Other	
Academic						
University	16	–	4	–	11	1
CAT	3	10	–	–	4	–
Tech. College	11	24	31	–	19	9
School	5	10	8	–	8	2
Other	1	4	2	–	8	–
Industry	27	31	34	–	27	60
Other	37	21	21	–	23	29
Number (= 100 %)	106	29	140	9	26	65
Not known (% of grand total)	7	6	26	–	24	10
Grand total	114	31	189	9	34	72

Source: Staff survey.

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